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MODEL 7005A

T1 BRIDGING ERROR DETECTOR

INSTALLATION, OPERATION AND SERVICE

Northeast Electronics Instruction Manual
A7005-10-600 Issue 2 July 1978

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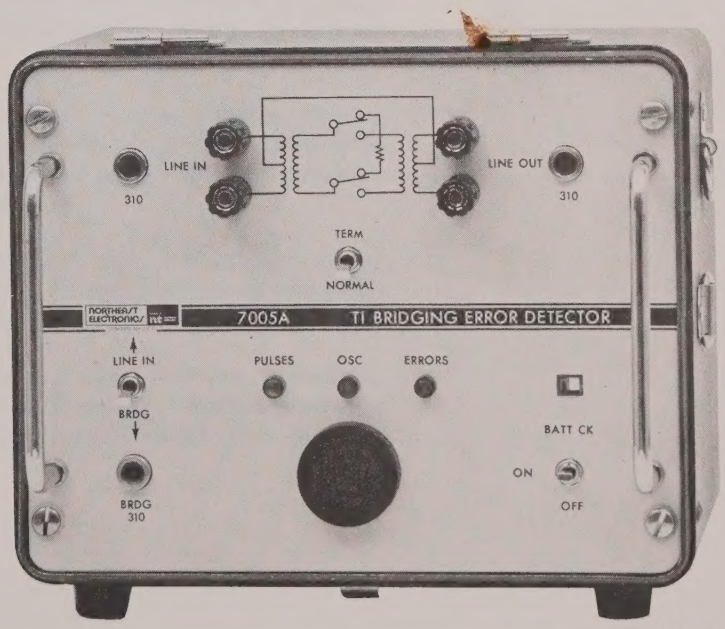

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Northeast Electronics Instruction Manual
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MODEL 7005A

ADDENDUM

3—31—79

A7005-10-600, Issue 2

Add the following operational note after paragraph 4.22

4.23 BROKEN WIRE FAULTS

4.24 In some rare instances, a bridging error detector may fail to reveal a broken wire fault. This detection failure is more likely to occur if the line length between the bridging error detector and the repeater generating the signal is short.

4.25 Such a condition may arise when trying to identify a fault caused by a tip or ring break in the short end section of a span (the end section is usually 3 kft.).

4.26 In this case, capacitive coupling may pass sufficient signal to the very sensitive bridging error detector. Thus the Model 7005A might indicate an error free pulse stream while the receiving repeater would continue to have difficulties.

4.27 If such a situation is suspected, a dc measurement can be made. Defuse the line (remove power) and make a continuity check from the measurement point to the repeater beyond the suspected break.

4.28 Note that the continuity check is a last resort test. Suspect the repeater first and replace it if a spare is available. Usually a good input and a bad output indicates a faulty repeater even when short line sections are involved.

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SECTION 1

GENERAL DESCRIPTION

1.1 This manual describes the Northeast Electronics Model 7005A T1 Bridging Error Detector. The Model 7005A is a solid-state, battery-powered, portable instrument. The high input impedance allows bridging across a T-carrier-repeatered line without disturbing operation. The 7005A indicates presence of normal pulses, bipolar violations, and oscillations at the input or output of a repeater, at a cable splice, at a main frame, or at any other accessible point inside or outside the central office.

1.2 The signal indications described above are also possible in a sectionalization mode of operation. The 7005A can be placed in series with a T-carrier line. The T-carrier input signal may be carried through or terminated while being monitored. Simplexed line power is carried through the test set in this mode. The location of the fault is suggested by signal monitor readouts, especially the change of status that may occur when the input signal is switched from a through connection to a terminating connection.

1.3 The circuitry of the 7005A includes an input signal amplifier with self-regulating, self-equalizing, clock recovery, and regeneration features similar to those found in most self-regulating repeaters. Signal fault detectors identify all ones and nominal 10 kHz oscillations. Audible and visual alerts are issued when a bipolar violation or oscillation is detected.

1.4 Operating power is supplied by nine series-connected D cells. Expected battery life is 30 hours of continuous operation at room temperature. A front-panel meter gives a go/no-go indication of battery condition.

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SECTION 2

SPECIFICATIONS

2.1 Table 2—1 is a list of specifications for the Model 7005A Bridging Error Detector.

Table 2—1. Model 7005A Bridging Error Detector Specifications.

INPUT	
Bridging input impedance:	3,000 ohms at 772 kHz.
Terminating impedance:	100 ohms ±10%.
Range:	Line losses from 0 to 36 dB at 772 kHz, self-equalizing.
DETECTION/INDICATION	
PULSES indicator:	When active alone, flashes approximately 10 times per second to indicate fault-free input. When active with OSCILLATION indicator, presence of all ones (8:8) oscillation is indicated. Will not become active in presence of nominal 10 kHz oscillation.
ERRORS indicator:	Flashes up to 10 times per second to indicate bipolar violations. Will not become active in presence of nominal 10 kHz oscillation.
OSCILLATION indicator:	Flashes approximately 10 times per second to indicate presence of the all ones (8:8) oscillation; the PULSES indicator flashes in unison. When on steadily, presence of 10 kHz is indicated.
Audible alert:	Beeps approximately 10 times per second to indicate all ones oscillation; up to 10 times per second to indicate bipolar violation. On continuously for 10 kHz oscillation.
POWER:	9 D cells
TEMPERATURE RANGE	
Using carbon-zinc batteries:	0°C to 50° (32°F to 122°F)
Using alkaline-manganese batteries:	−25°C to +60°C (−13°F to 140°F)
RELATIVE HUMIDITY:	0 to 85%
SIZE:	7 in. h x 9 in. w x 9 1/8 in. d (17.8 cm x 22.9 cm x 23.2 cm)
WEIGHT:	11 pounds (5 kg)

SECTION 3

INSTALLATION

3.1 The Model 7005A is a portable test set and requires no installation.

3.2 INITIAL INSPECTION

3.3 The Model 7005A was carefully inspected, both mechanically and electrically, before shipment. It should be free of defects and should be operating correctly when received. To confirm this, the set should be visually inspected for signs of damage that may have occurred during shipment. If there is shipment damage, notify the carrier immediately. Electrical operation can be quickly checked by placing the unit into operation.

3.4 RETURN MATERIAL AUTHORIZATION

3.5 As detailed on the back side of the sales agreement, Northeast Electronics warrants its instruments for a period of one year to the original purchaser. Before returning any piece of equipment to the factory for repair, a return material authorization number must be obtained from Northeast Electronics. To obtain this authorization, telephone the Customer Service Department at (603) 224-6511.

3.6 POWER CONNECTIONS

3.7 The Model 7005A is powered by internal batteries. No external power connections are required.

3.8 SIGNAL CONNECTIONS

3.9 T-carrier signal connections are made according to the type of testing and troubleshooting work being performed. Refer to operating information in Section 4 for signal connection data.

SECTION 4

OPERATION

4.1 CONTROLS, INDICATORS, AND JACKS

4.2 All operating controls are shown in Figure 4—1 and described in Table 4—1.

Table 4—1. Model 7005A Controls, Indicators, And Jacks

REF DESIG	CONTROL, INDICATOR, OR JACK	FUNCTION
J1	BRDG 310 jack	Connector for type 310 telephone plug for bridging across T-carrier line.
J2	LINE IN 310 jack	Connector for type 310 telephone plug for connecting incoming section of interrupted T-carrier line to test set.
J3	LINE OUT 310 jack	Connector for type 310 telephone plug for connecting outgoing section of interrupted T-carrier line to test set.
J4,J5	LINE IN binding posts	Wired in parallel with J2; J4 is tip, J5 is ring.
J6,J7	LINE OUT binding posts	Wired in parallel with J3; J6 is tip, J7 is ring.
S1	BATTERY CHECK/ON/OFF switch	Three-position toggle switch. Connects battery to internal circuits in ON position. Connects battery to meter for go/no-go test in BATTERY CHECK. Also activates indicators when switch is in BATTERY CHECK.
S2	TERM/NORMAL switch	In NORMAL position, the T-carrier input is carried through to the output. In TERM position, the T-carrier input is terminated with 100 ohms.
S3	LINE IN/BRIDGE switch	Connects internal circuits to bridging input (BRIDGE) or line input (LINE IN).
DS1 DS2 DS3	ERRORS indicator PULSES indicator OSCILLATION indicator	When the T-carrier input is normal, the PULSES indicator will flash ten times per second; the ERRORS and OSCILLATION indicators will not flash. When a bipolar violation occurs, the ERRORS indiator will flash. Bursts of violations will cause the indicator to flash up to ten times per second. The PULSES indicator remains active in the presence of bipolar violations. The presence of all ones oscillations will cause the OSCILLATION indicator to flash ten times per second. The PULSES indicator will also flash; the ERRORS indicator may flash. The PULSES and ERRORS indicators will not become active if 10 kHz oscillations are present. The OSCILLATION indicator will remain on steadily, although it will blink if the 10-kHz oscillation drops in and out. If the T-carrier input is not recoverable, all indicators will remain off.

Table 4—1. (Cont'd)

REF DESIG	CONTROL, INDICATOR OR JACK	FUNCTION
LS1	Sonalert	Provides audible alarm to signal errors or oscillation; ten beeps per second could indicate either type of fault, but slower rate indicates errors. A single error produces a single beep. On continuously for 10 kHz OSCILLATION.
M1	Go/no-go battery meter	Placed in circuit when S1 is in BATTERY CHECK position. White area represents GO. Center line reading represents 8.5 volts.

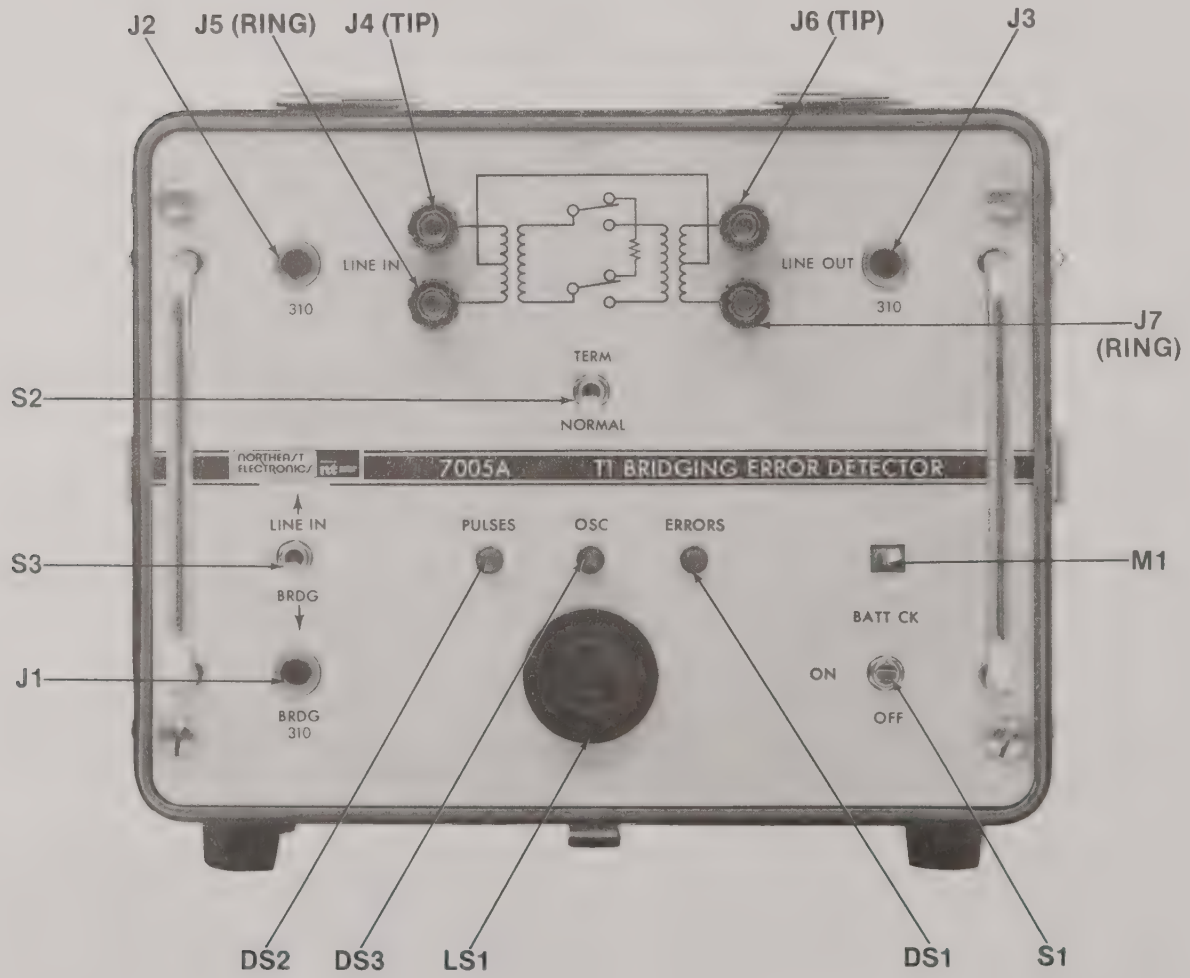


Figure 4—1. Model 7005A Front Panel Controls, Indicators, And Jacks.

4.3 GENERAL OPERATING INSTRUCTIONS

4.4 The Model 7005A is operated in the direct **bridging mode** to test T-carrier signals without interrupting service. The **sectionalizing mode** enables the user to determine in which direction a fault lies, i.e. toward the source or toward the destination. When sectionalizing tests are made, continuity on the line under test is broken thereby interrupting normal service.

NOTE

The high-impedance input of the self-regulated 7005A is not affected by the length of the connecting cord. However, normal T1 lines may be seriously affected by bridging even a few hundred picofarads across them. Thus, the patch cord length should never exceed 12 feet total (two 6-foot cords for sectionalizing or one 12-foot cord for bridging). These lengths may be doubled when using 22-gauge twisted pair (frame wire) or "zip" cord. In any case, use of the shortest length possible minimizes degradation.

4.5 BRIDGING MODE

4.6 In this mode, the high-impedance measuring circuits are bridged directly across the line under test. To operate in the bridging mode, perform the following steps.

1. Throw BATTERY CHECK/ON/OFF to BATTERY CHECK. The three indicators must become active. The speaker must be on steadily. The meter must read in the white area. (See Section 6 for details on battery replacement.)

2. Throw BATTERY CHECK/ON/OFF to ON.

3. Insert a suitable patch cord into BRDG 310 jack.

4. Using the patch cord, make a bridging connection to the line under test.

5. Throw LINE IN/BRIDGE toggle to BRIDGE.

6. Monitor indicators and speaker. See Table 4—2. If no faults are detected, the problem is down the line toward the destination. If faults are detected, sectionalize per paragraph 4.7.

4.7 SECTIONALIZING MODE

4.8 In this mode, the line under test must be interrupted momentarily to allow the test set's sectionalizing capability to be inserted in series with the line. To sectionalize a trouble, perform the following steps.

1. Throw BATTERY CHECK/ON/OFF to BATTERY CHECK. The three indicators must become active. The speaker must be on steadily. The meter must read in the white area. (See Section 6 for details on battery replacement.)

2. Break line connections.

3. Connect incoming line pair to LINE IN 310 jack or to binding posts.

4. Connect outgoing line pair to LINE OUT 310 jack or binding posts.

NOTE

The upper binding post of each pair is the tip connection.

5. Throw LINE IN/BRIDGE toggle to LINE IN.

6. Throw BATTERY CHECK/ON/OFF toggle to ON.

7. If the line under test has already been found faulty at this point of the line in the bridging mode, proceed to step 8. Otherwise test the carried-through line as follows.

a. Throw TERM/NORMAL toggle to NORMAL.

b. Monitor indicators and speaker. If no faults are detected, the problem is down the line toward the destination. If faults are detected, proceed to step 8.

8. Throw TERM/NORMAL toggle to TERM.

9. Monitor indicators and speaker. If signal faults are indicated, the problem is toward the source. If no faults are indicated, the problem is toward the destination.

Table 4—2. Indicator Lamp Combinations.

TYPE SIGNAL	INDICATOR LAMPS			AUDIBLE ALARM
	PULSES	ERRORS	OSC	
NORMAL	FLASH	OFF	OFF	OFF
ERRORS	FLASH	FLASH	OFF	BEEPING
ALL ONES	FLASH	OFF*	FLASH	BEEPING
10 kHz	OFF	OFF	STEADY	STEADY

* Normally off but will flash if bipolar violations detected.

4.9 BRIDGING APPLICATIONS IN A CENTRAL OFFICE

4.10 As shown by Figure 4—2, the Model 7005A can make bridging tests anywhere in the central office. The following features enable the 7005A to be applied to testing tasks for which many error detectors are not suited:

1. The Model 7005A does not require a 48-Vdc power source.

2. The Model 7005A detects low level T1 signals.

4.11 SECTIONALIZING IN A CENTRAL OFFICE

4.12 The Model 7005A can be used in the sectionalizing mode whenever it is necessary to determine if the cause of a failure lies with either: (a) the source of a faulty T1 signal, or (b) the impedance presented by the destination. The sectionalizing mode is particularly useful in isolating a fault to either the central office itself or to the outside plant. Figure 4—3 shows a sectionalizing operation on a T1 line outgoing from the central office. A similar method can be used on an incoming T1 line. Sectionalizing tests interrupt normal service on the line.

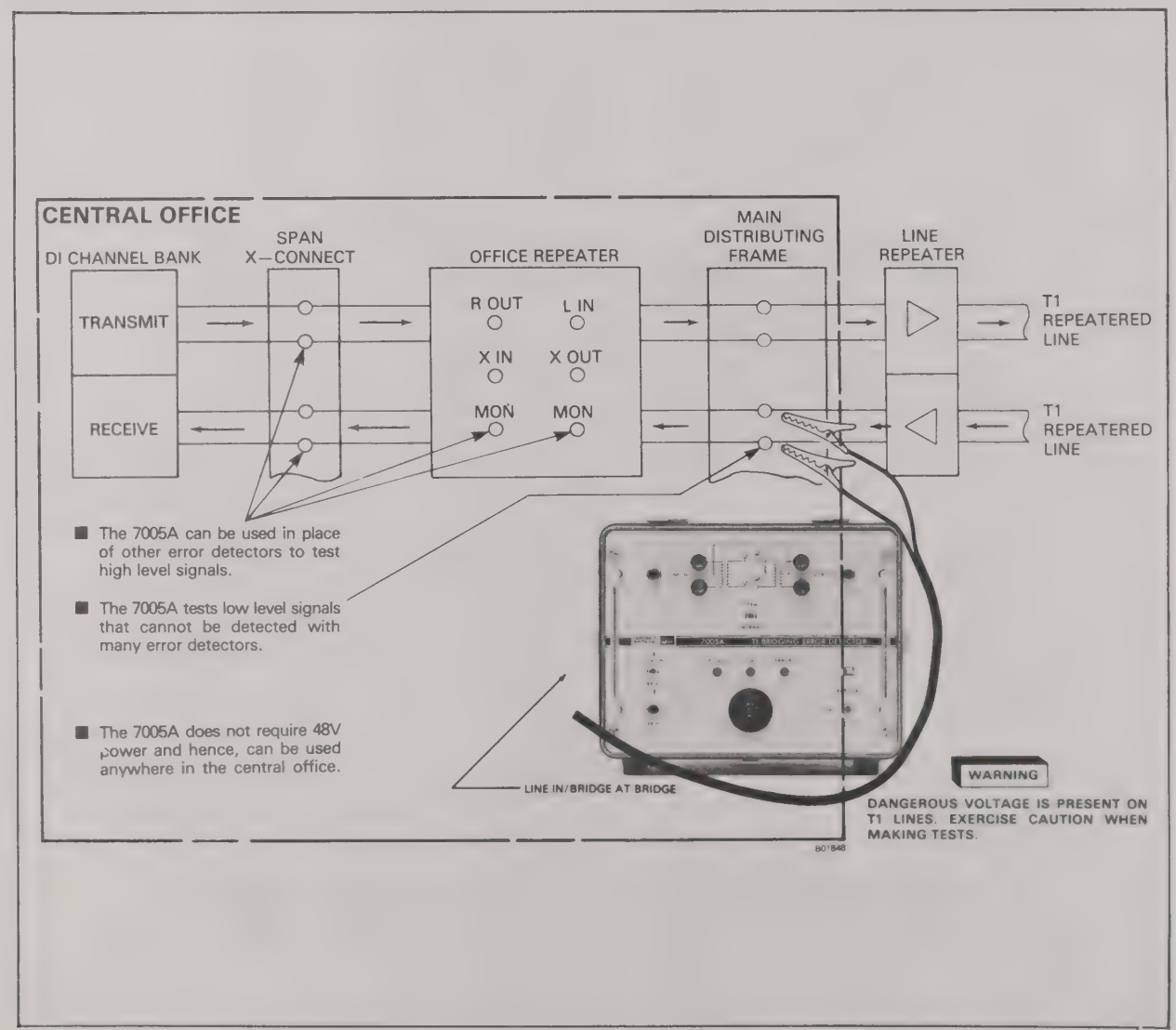
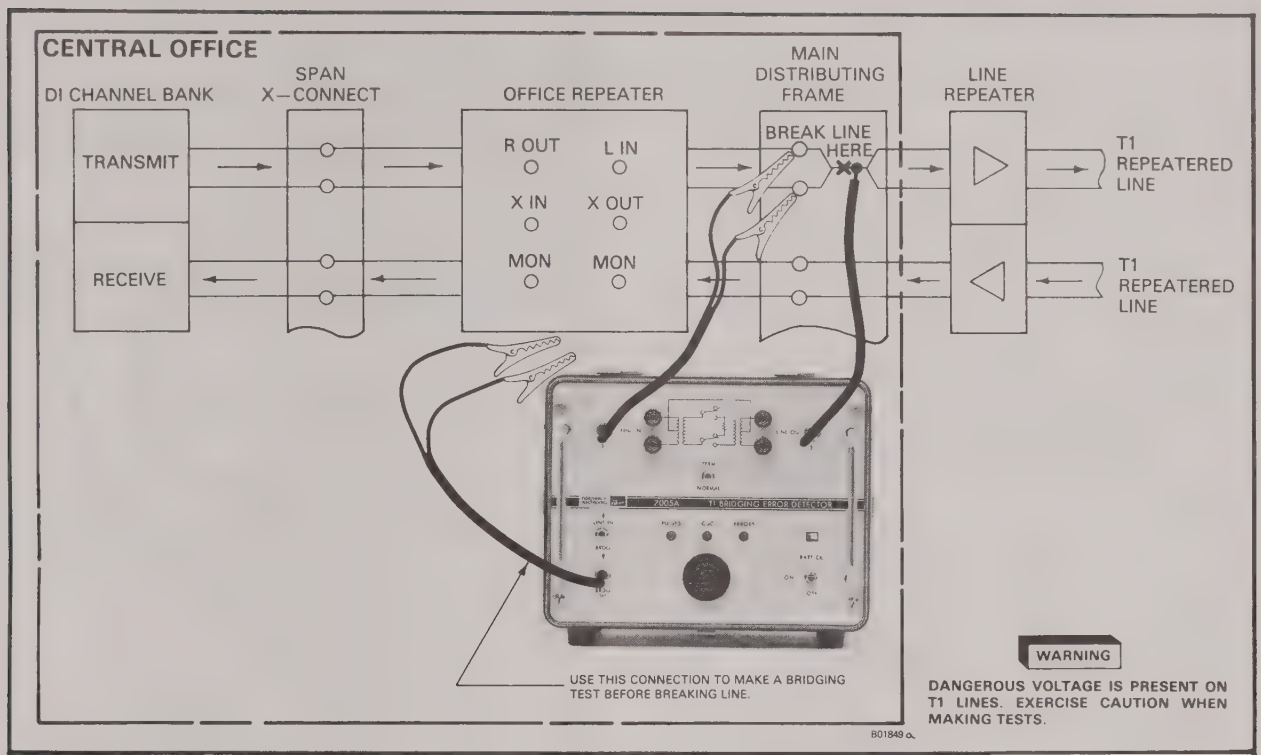
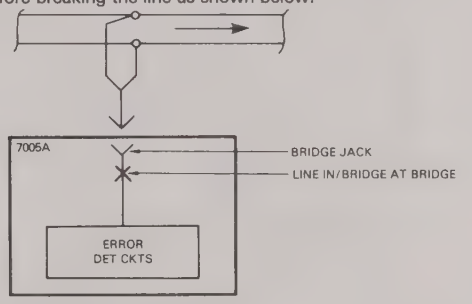

CENTRAL OFFICE
DI CHANNEL BANK
SPAN X—CONNECT
OFFICE REPEATER
MAIN DISTRIBUTING FRAME
LINE REPEATER
TRANSMIT
RECEIVE
R OUT
L IN
X IN
X OUT
MON
MON
T1 REPEATERED LINE
T1 REPEATERED LINE
■ The 7005A can be used in place of other error detectors to test high level signals.
■ The 7005A tests low level signals that cannot be detected with many error detectors.
■ The 7005A does not require 48V power and hence, can be used anywhere in the central office.
LINE IN/BRIDGE AT BRIDGE
WARNING
DANGEROUS VOLTAGE IS PRESENT ON T1 LINES. EXERCISE CAUTION WHEN MAKING TESTS.

Figure 4—2. Bridging Applications In A Central Office

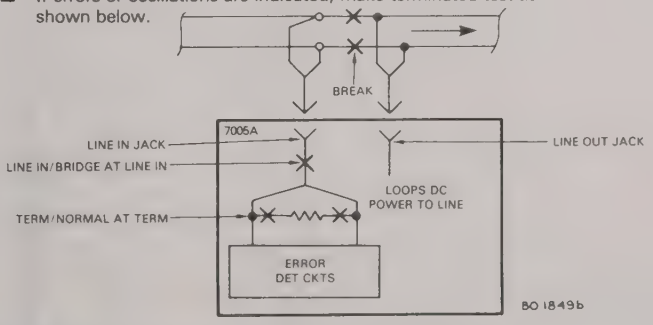


- Make bridging test before breaking the line as shown below.



- If 7005A indicates neither errors nor oscillations, the CO equipment is functioning properly.

- If errors or oscillations are indicated, make terminated test as shown below.



- If 7005A indicates either errors or oscillations, the problem is confined to the CO. Otherwise, the problem lies in the outside plant.

Figure 4—3. Typical Sectionalizing Operation In A Central Office

4.13 BRIDGING TESTS ON A T1 SPAN LINE

4.14 The Model 7005A can be used to make bridging tests on a span line wherever access to the line can be obtained. As shown by Figure 4—4, terminals on the line repeater housing can be used to bridge a span line at either side of the line repeater. If the Model 7005A indicates either errors or oscillations, it may be necessary to troubleshoot further by making sectionalizing tests as shown on Figures 4—5 and 4—6.

4.15 SECTIONALIZING AT A LINE REPEATER INPUT

4.16 This sectionalizing operation (shown in Figure 4—5) allows the user to determine if the cause of a failure lies with either: (a) the source of the faulty T1 signal, or (b) with the impedance presented by the line repeater at the destination. Sectionalizing per Figure 4—5 interrupts normal service on the line under test.

4.17 SECTIONALIZING AT A LINE REPEATER OUTPUT

4.18 Sectionalizing per Figure 4—6 allows the user to determine if a problem lies with either: (a) the source direction, or (b) the impedance presented by the destination. Sectionalizing per Figure 4—6 interrupts normal service on the line under test.

4.19 SECTIONALIZING BETWEEN LINE REPEATERS

4.20 This sectionalizing operation can be performed whenever a splice or other access point exists between repeaters on a span line under test. Figure 4—7 illustrates this application. Sectionalizing per Figure 4—7 interrupts normal service on the line.

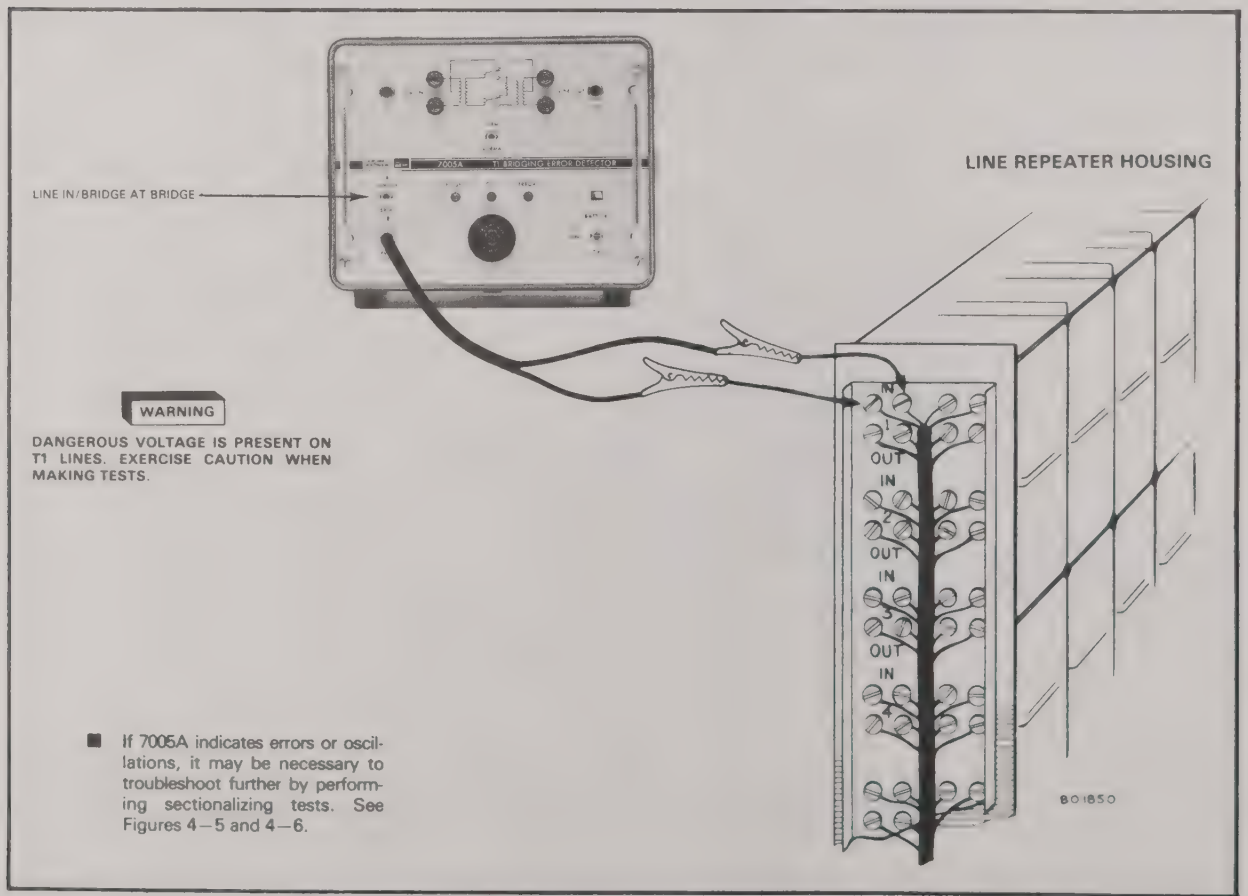
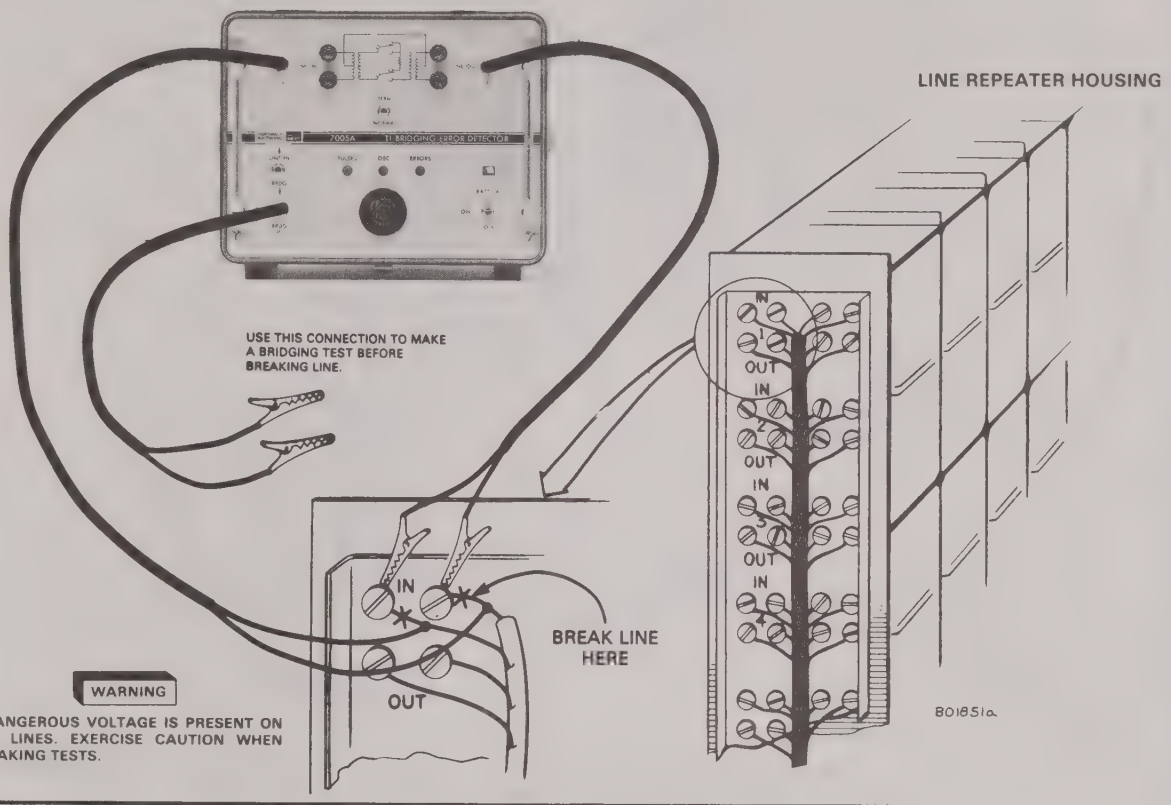
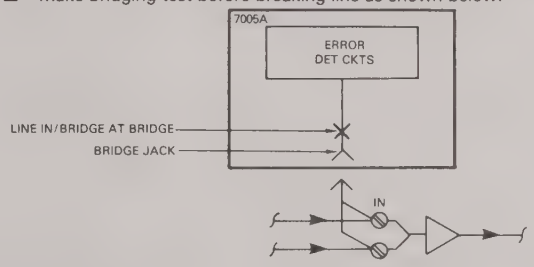


Figure 4—4. Bridging Points On A Line Repeater Housing

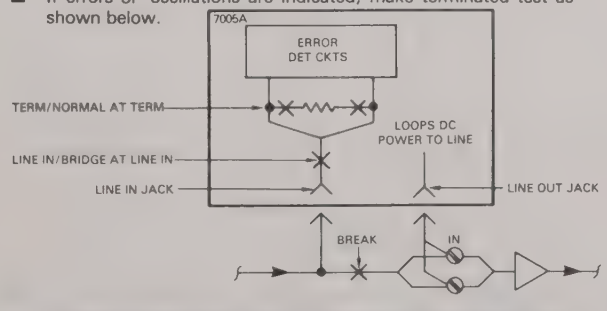

LINE REPEATER HOUSING
USE THIS CONNECTION TO MAKE A BRIDGING TEST BEFORE BREAKING LINE.
IN
OUT
BREAK LINE HERE
WARNING
DANGEROUS VOLTAGE IS PRESENT ON T1 LINES. EXERCISE CAUTION WHEN MAKING TESTS.
B01851a

■ Make bridging test before breaking line as shown below.



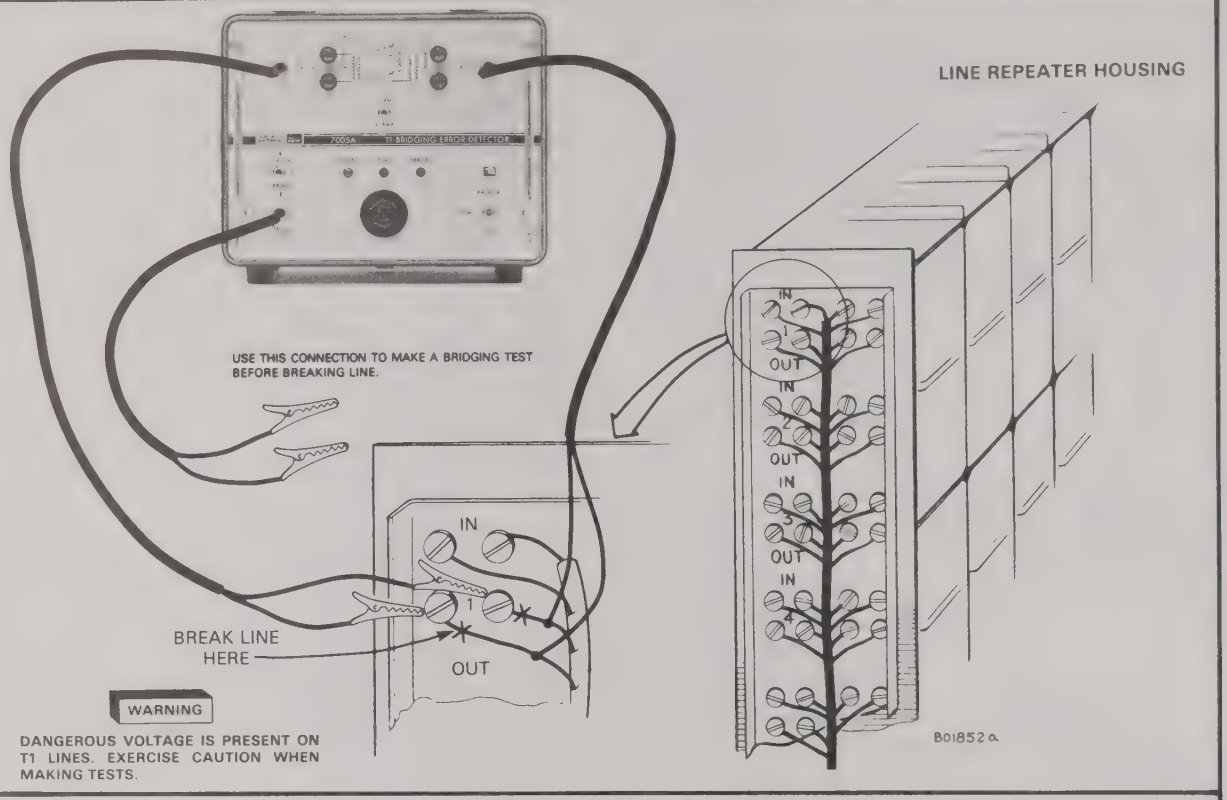
■ If 7005A indicates neither errors nor oscillations, span line from source is good.

■ If errors or oscillations are indicated, make terminated test as shown below.

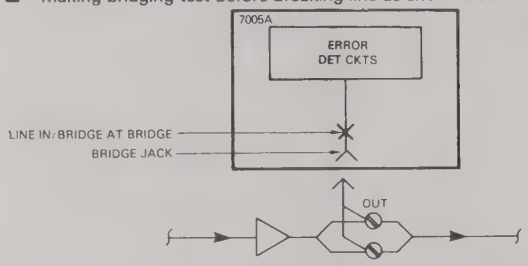


■ If 7005A indicates either errors or oscillations, problem lies in the source direction. Otherwise, repeater at destination is defective.

Figure 4—5. Sectionalizing At A Line Repeater Input

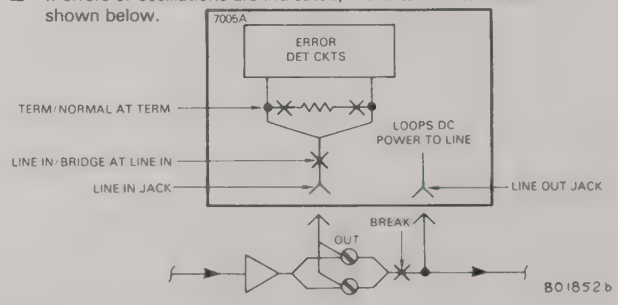


- Making bridging test before breaking line as shown below.



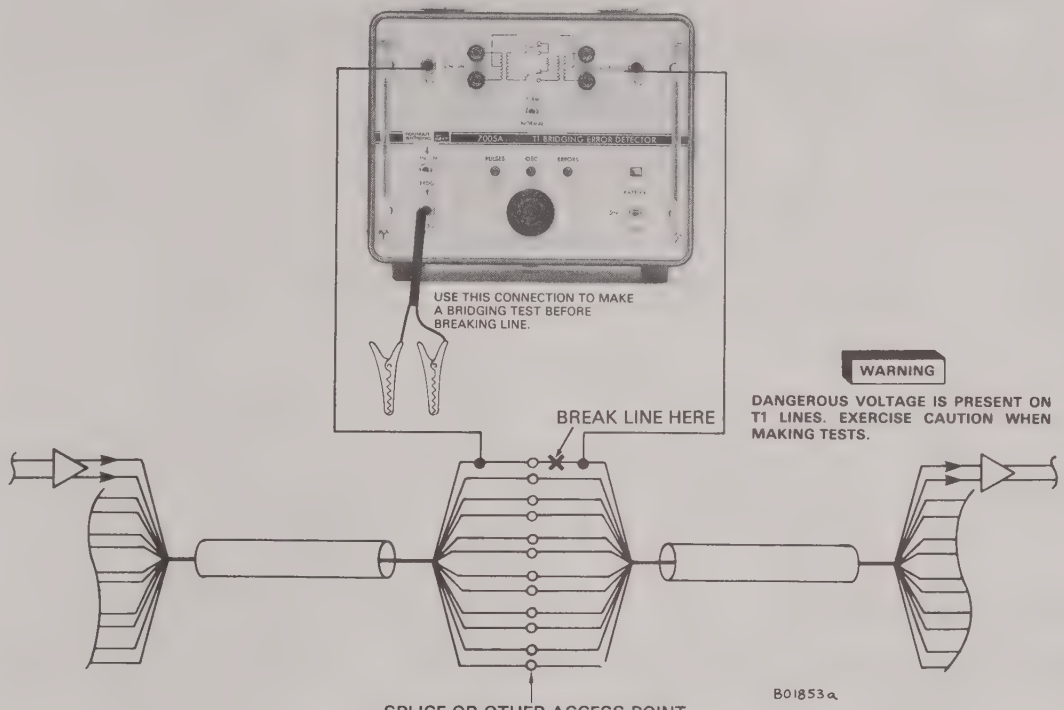
- If 7005A indicates neither errors nor oscillations, repeater at source is good.

- If errors or oscillations are indicated, make terminated test as shown below.

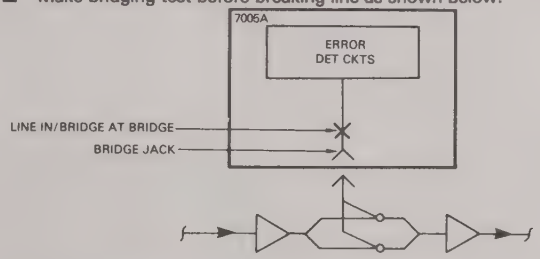


- If 7005A indicates either errors or oscillations, the problem lies in the source direction. Otherwise, a fault exists in either: (1) the span line to the destination, or (2) the repeater at the destination.

Figure 4—6. Sectionalizing At A Line Repeater Output

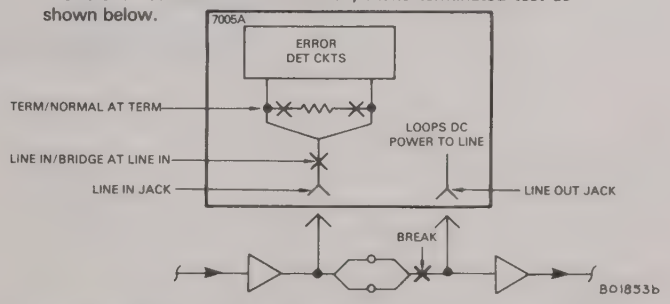

USE THIS CONNECTION TO MAKE A BRIDGING TEST BEFORE BREAKING LINE.
WARNING
DANGEROUS VOLTAGE IS PRESENT ON T1 LINES. EXERCISE CAUTION WHEN MAKING TESTS.
BREAK LINE HERE
B01853a
SPLICE OR OTHER ACCESS POINT ALONG SPAN LINE

■ Make bridging test before breaking line as shown below.



■ If 7005A indicates neither errors nor oscillations, span line from source is good.

■ If errors or oscillations are indicated, make terminated test as shown below.



■ If 7005A indicates either errors or oscillations, the problem lies in the source direction. Otherwise, a fault exists in either: (1) the span line to the destination, or (2) the repeater at the destination.

Figure 4—7. Sectionalizing Between Line Repeaters

4.21 SPAN LINE TESTING USING THE MODEL 7015 WITH THE 7005A

4.22 The Model 7015 Repeater Slot Extender can be used in conjunction with the Model 7005A to make bridging and sectionalizing tests on a T1 span line. The Model 7015 is particularly suited for applications where electrical shock hazards are to be avoided. Figures 4—8 through 4—10 illustrate bridging and sectionalizing tests using the Model 7015. Normal service is always interrupted whenever the Model 7015 is used.

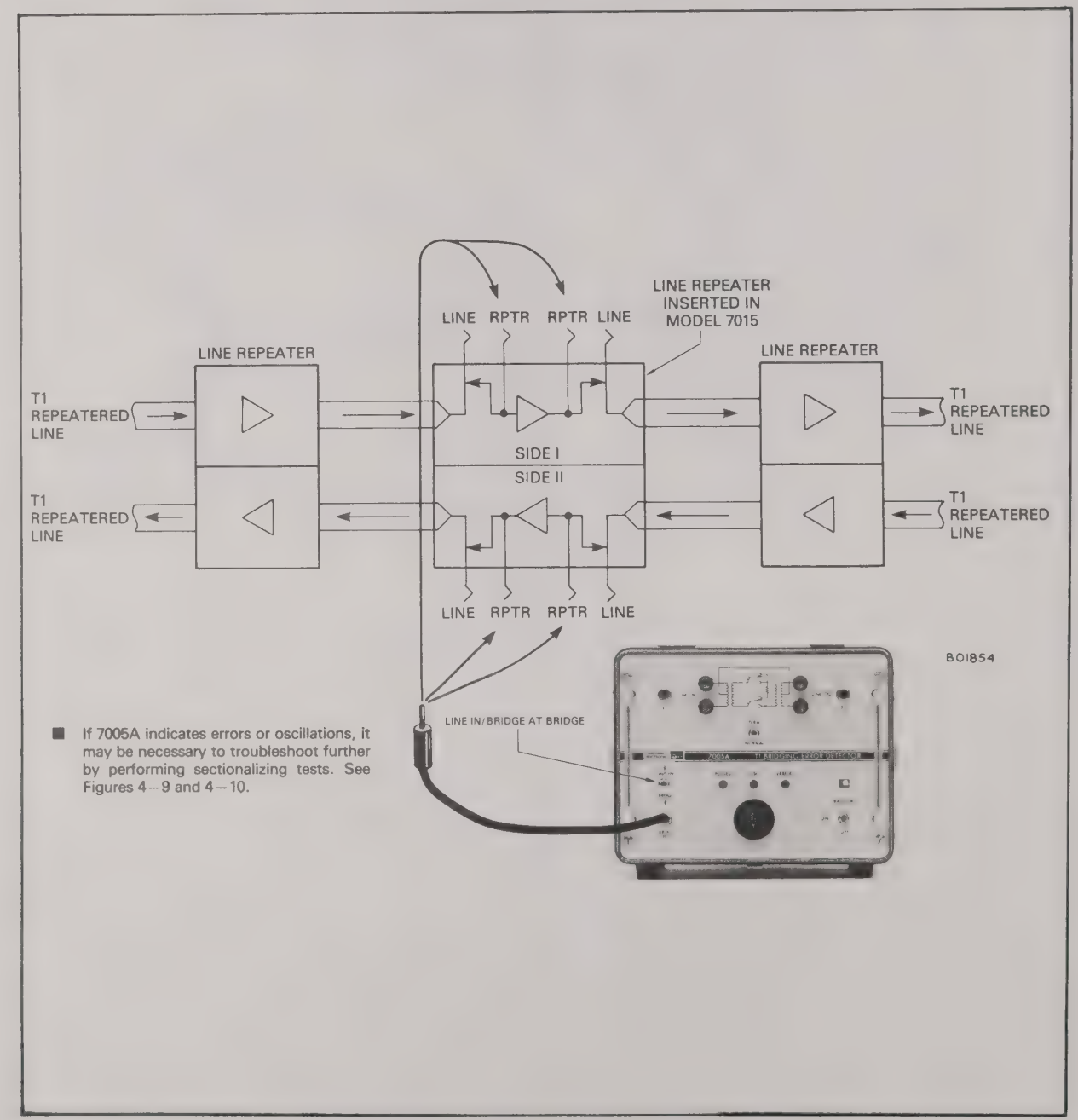
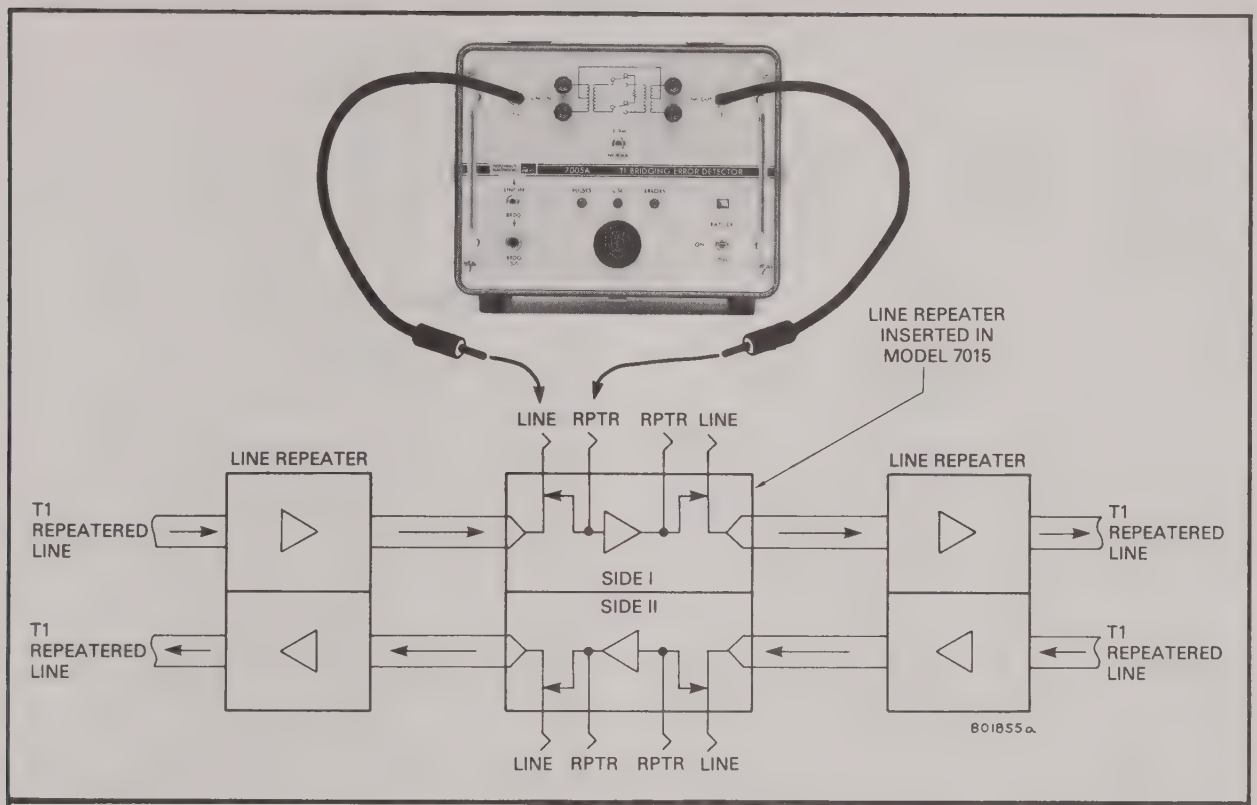
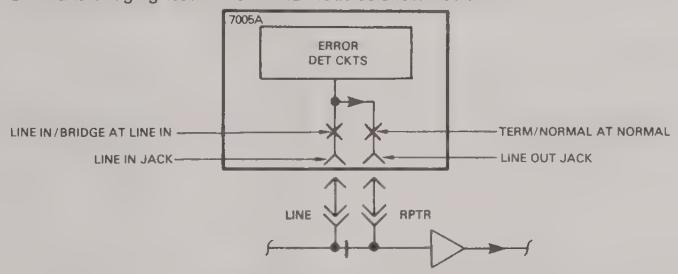

LINE REPEATER INSERTED IN MODEL 7015
LINE RPTR RPTR LINE
LINE REPEATER
LINE REPEATER
T1 REPEATED LINE
T1 REPEATED LINE
SIDE I
SIDE II
T1 REPEATED LINE
T1 REPEATED LINE
LINE RPTR RPTR LINE
B01854
LINE IN/BRIDGE AT BRIDGE
■ If 7005A indicates errors or oscillations, it may be necessary to troubleshoot further by performing sectionalizing tests. See Figures 4—9 and 4—10.

Figure 4—8. Bridging Tests Using The Model 7015 With The 7005A

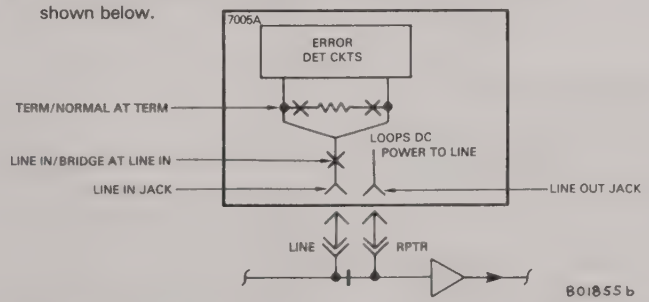


- Make bridging test in NORMAL mode as shown below.



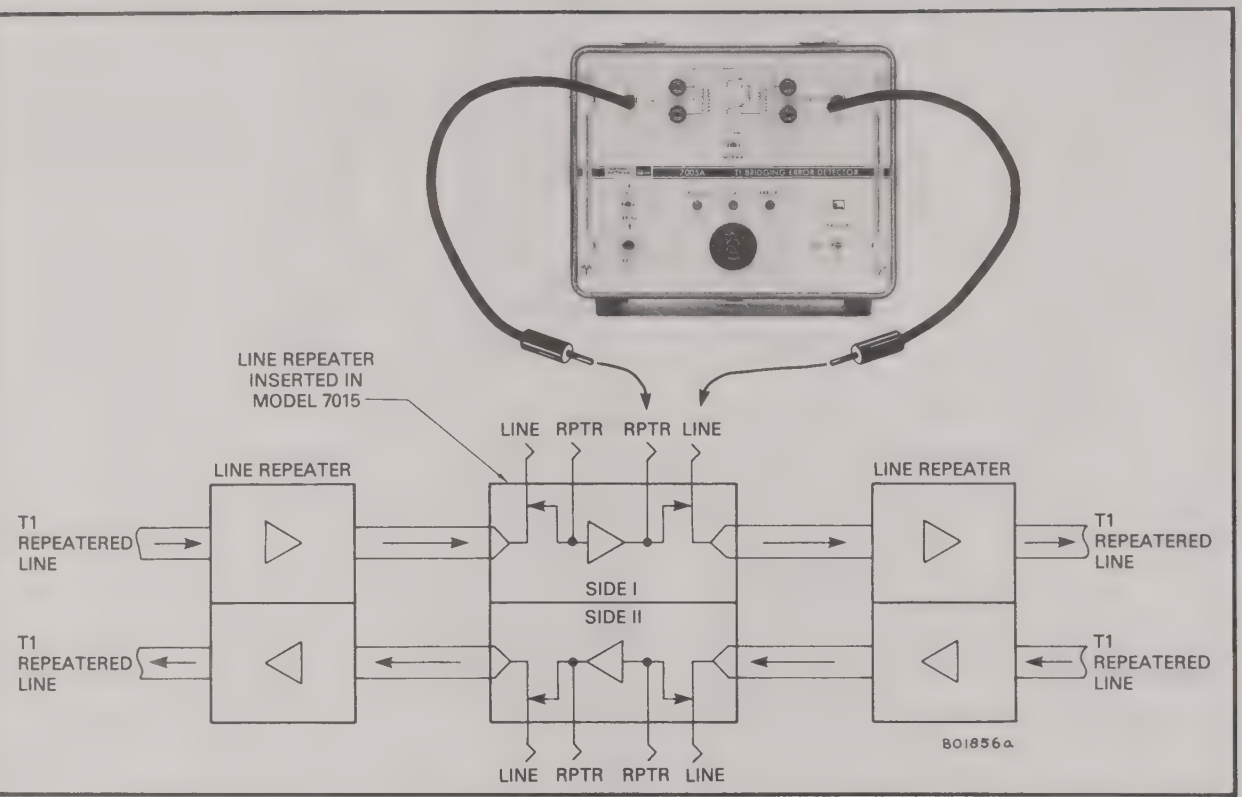
- If 7005A indicates neither errors nor oscillations, span line from source is good.

- If errors or oscillations are indicated, make terminated test as shown below.

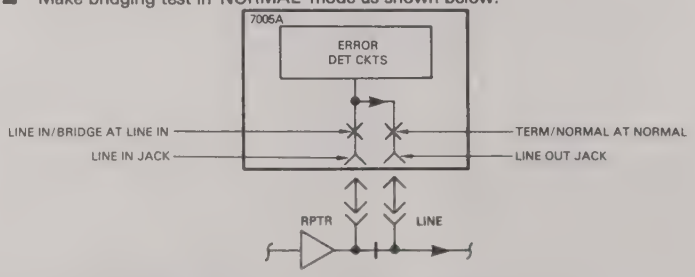


- If 7005A indicates either errors or oscillations, problem lies in the source direction. Otherwise, repeater at destination is defective.

Figure 4—9. Sectionalizing At A Line Repeater Input Using The Model 7015 With The 7005A

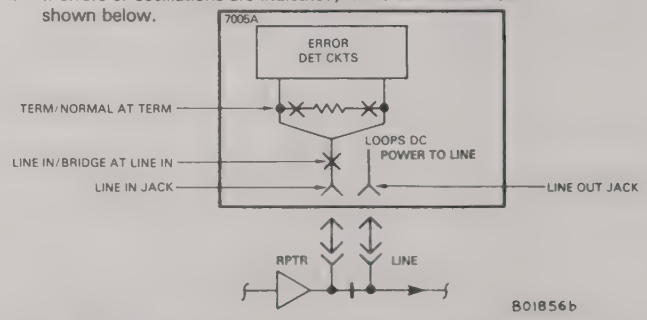


■ Make bridging test in NORMAL mode as shown below.



■ If 7005A indicates neither errors nor oscillations, repeater at source is good.

■ If errors or oscillations are indicated, make terminated test as shown below.



■ If 7005A indicates either errors or oscillations, the problem lies in the source direction. Otherwise, a fault exists in either: (1) the span line to the destination, or (2) the repeater at the destination.

Figure 4—10. Sectionalizing At A Line Repeater Output Using The Model 7015 With The 7005A

SECTION 5

THEORY OF OPERATION

5.1 This section provides circuit descriptions for the Model 7005A Bridging Error Detector. A discussion of the circuits on a functional level precedes a detailed description.

5.2 **FUNCTIONAL BLOCK DIAGRAM DESCRIPTION.**

5.3 This description refers to Figure 7—1. The Model 7005A includes: (1) an input switching and terminating section on Error Detector Board A1, (2) an automatic line build-out preamplifier on ALBO Preamplifier Board A2, and (3) a signal monitor section on A1.

5.4 INPUT SECTION.

5.5 This section is designed to accept a bridging connection to an uninterrupted line, or incoming and outgoing connections to an interrupted line. The line connections are made such that the incoming signal can either be carried through or terminated. Provisions are made for connecting either the bridging signal or incoming line signal to the test set's monitor circuits. When S3 is in the BRIDGE position, a T1 line can be connected through BRDG 310 jack J1 to input transformer A2T1. The high impedance of A2T1 avoids disturbance of the bridged line. The incoming end of an interrupted T1 line is connected to A2T1 through LINE IN 310 jack J2 when S3 is in the LINE IN position. The incoming line is carried through when S2 is in the NORMAL position or terminated with 100 ohms with S2 in the TERM position. Span line power is carried through in either position of S2. LINE OUT jack J3 connects the outgoing end of the interrupted line to the test set. Binding post pairs J4/J5 and J6/J7 are parallel-connected with J2 and J3, respectively.

5.6 ALBO PREAMPLIFIER SECTION.

5.7 ALBO (automatic line build-out) Board A2 performs three major funcitons.

1. Automatically compensates for the variation of energy distribution within the T1 carrier bandwidth and the variations of input peak levels as a function of test location on a line.

2. Regenerates input digital information for use by the test set's error and pulse detector circuits.

3. Detects presence of nominal 10 kHz oscillation.

5.8 The digital signal from transformer T1 is applied to preamplifier U1-U2. Impedances Z1 and Z2 in the feedback path provide fixed equalization for the maximum cable length in addition to high-frequency gain roll-off. The preamplifier output is transformer-coupled to the threshold detector. Pulses are extracted from the center tap of this transformer. These pulses feed the AGC and clock recovery circuits. AGC amplifier Q3 and Q6 delivers to C5 a current that is proportional to the peak amplitude of the input signal. The discharge current of C5 controls the small-signal resistance of diodes CR1-4. The network including R1, R2, C3 and the small-signal diode resistance provides a variable, low-frequency flat gain and a variable break-point frequency that automatically matches cable characteristics from zero to 6000 feet of 22-gauge pulp cable or equivalent.

5.9 The clock recovery circuit includes a tank resonant at 1.544 MHz. The tank is excited by pulses from the T1 center tap. Because this circuit is not self-sustaining, these pulses are required to start the clock and to maintain oscillatory circuit current. Clock shaper Q10 modifies the clock output to a form suitable for the pulse separator.

5.10 The threshold detector produces a pulse for each input pulse exceeding a predetermined minimum level. Detector outputs are clocked into flip-flops by the input from Q10. The regenerated pulses are supplied in a unipolar, double rail format. Positive input pulses appear as T DATA; negative input pulses appear as R DATA

5.11 Amplifier U7 and network Z3 and Z4 make up a lowpass filter. Input rates of approximately 23 kHz or less produce an output recognized by detector board A1 as nominal 10 kHz oscillations.

5.12 The ALBO Preamplifier Board includes 5- and 6.5-volt regulators.

5.13 ERROR DETECTOR SECTION

5.14 The functions of the Error Detector section are:

1. Detect and display pulses,

2. Detect and display bipolar violations,

3. Detect and display presence of oscillations, and

4. Provide audible alarms for signaling presence of errors and oscillations.

5.15 The T DATA and R DATA inputs are OR'd to produce T+R PULSES, which trigger pulse rate circuit U6 and error detector U1 and U2. The pulse rate circuit produces a 10 Hz rectangular wave in the presence of pulses from the T-carrier line. This wave controls PULSES indicator DS2 when not inhibited by the presence of 10 kHz oscillations. The error detector produces one ERROR PULSE for each bipolar violation. The error rate circuit produces an output pulse for each ERROR PULSE up to ten per second. The output of U7 controls ERRORS indicator DS1 through U3C. The error-rate circuit is inhibited when 10 kHz oscillations are present.

5.16 The LFO (Low Frequency Oscillation) input voltage is compared to a reference level. The reference will be exceeded when T-carrier signals exhibit rates below approximately 23 kHz. Complementary outputs are provided. The 10 kHz PRESENT signal controls OSCILLATION indicator DS3. The $\overline{10 \text{ kHz PRESENT}}$ signal inhibits the PULSES and ERRORS indicators. The T DATA input feeds all ones oscillation detector U8C, U8D, and U8F. The detector is designed to detect the occurrence of approximately 725 or more ones with no intervening zeros. When this condition is detected, the ALL ONES PRESENT signal becomes active. This signal is gated by 10 Hz PULSE RATE to produce a flashing indication.

5.17 Pulses that activate the ERRORS and OSCILLATION indicators also drive sonalert LS1 via OR gate U5D and U4D and amplifier Q1. Volume is preset by R13.

5.18 Go/no-go meter M1 is connected when S1 is in the BATTERY CHECK position. The calibration potentiometer is set to produce a center-scale reading with an 8.5-volt input. A lamp test voltage is enabled when S1 is toggled to the BATTERY CHECK position. This voltage enters the indicator circuits via OR gates.

5.19 DETAILED CIRCUIT DESCRIPTIONS

5.20 ALBO PREAMPLIFIER A2.

5.21 This discussion refers to Figure 7—5. The balanced input is converted to an unbalanced signal at T1-16. Line power is blocked by C1. Differential amplifier U1 and U2 (in conjunction with feedback components C8, R8, C9, L1, R10 and R9) provides the gain versus frequency characteristics necessary to ensure proper operation of the test set over a wide range of input signal conditions. The nominal low-frequency gain of 10 dB is established by R8 and R9. At approximately 80 kHz, the reactance of C9 is sufficiently low to become a significant factor in the feedback path. Gain increases at 6 dB per octave from this region to track the cable loss characteristics. This slope predominates with increasing frequency until the reactance of L1 becomes a counter-acting factor. The rising gain is checked at approximately 800 kHz. Gain peaks at 36 dB at 1 MHz. Above 1.5 MHz, gain rolls off at 12 dB per octave. The reactances of C8 and L1 are the controlling factors in this region. The balanced output of U1 is connected to T1-9,12.

5.22 Input pulses that are positive-going at T1—1 produce positive half cycles of energy at T1—5 and negative half-cycles at T1—8. Negative-going input pulses produce positive half cycles at T1—8 and negative half cycles at T1—5. Note that positive half cycles at T1—5 and T1—8 draw base current from Q1 and Q2. Now refer to Figure 5—1. The relationships of input pulses to voltages at T1—5 and T1—8 are shown in the upper poriton of Figure 5—1. The base currents produce negative half cycles across R15.

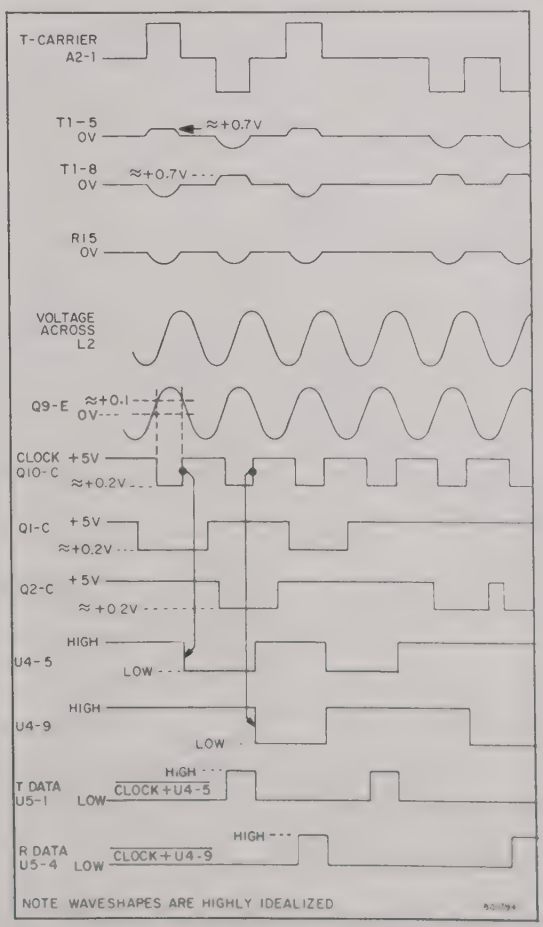


Figure 5—1. ALBO Preamplifier Data Regeneration

SECTION 6

MAINTENANCE AND CALIBRATION

6.1 BATTERY REPLACEMENT.

6.2 To replace the nine D cells in the unit, perform the following steps.

1. Loosen the four front panel captive screws and remove the chassis from the case.

2. Remove the four screws that secure the rear battery cover.

3. Observe the correct polarity and replace the cells.

4. Replace battery cover and screws.

5. Return the chassis to the case and secure the captive screws.

6.3 CALIBRATION.

6.4 Calibration is comprised of a Sonalert volume adjustment, a battery meter adjustment, and a clock recovery adjustment.

6.5 SONALERT VOLUME ADJUSTMENT.

6.6 To adjust the volume of the Sonalert, perform the following steps.

1. Loosen the four front panel captive screws and remove the chassis from the case.

2. See Figure 7—3 to locate A1R13.

3. Hold the BATTERY CHECK/ON/OFF switch in the BATTERY CHECK position and adjust A1R13 to obtain the desired Sonalert volume. To silence the device, adjust the potentiometer fully counterclockwise.

5. Return chassis to the case and secure the captive screws.

6.7 BATTERY METER ADJUSTMENT.

6.8 To calibrate the battery meter, perform the following steps.

1. Loosen the four captive screws and remove the chassis from the case.

2. Remove the battery cover and remove the batteries.

3. Connect a variable dc power supply across battery terminals FT1 (—) and FT2 (+).

4. Set the power supply output to 8.5 volts.

5. See Figure 7—3 to located A1R2.

6. Hold the BATTERY CHECK/ON/OFF switch in the BATTERY CHECK position and adjust A1R2 to obtain a mid scale indication on the battery check meter.

7. Set the BATTERY CHECK/ON/OFF switch to the OFF position.

8. Remove the power supply.

9. Replace the batteries and the battery cover.

10. Return the chassis to the case and secure.

6.9 CLOCK RECOVERY ADJUSTMENT.

6.10 To optimize the response of the clock recovery circuit, perform the following steps.

1. Loosen the four captive screws and remove the chassis from the case.

2. Connect a DS1-type PCM pseudo random signal to the BRDG 310 jack. This signal can be obtained from a Northeast Electronics Model 7046, 7040, or a 7007.

3. On A2, connect a high frequency oscilloscope (10 MHz) to clock test point DD. See Figure 7—4. Connect the oscilloscope ground to the signal ground.

4. Set the BATTERY CHECK/ON/OFF switch to ON.

5. Set the oscillosocpe sweep to trigger on the negative edge.

6. On A2, use a non-metallic tuning wand* to adjust L2 to minimize the phase jitter on the leading edge of the displayed clock pulse. If available, use the X10 sweep magnifier feature. This will make the adjustment end point more sensitive.

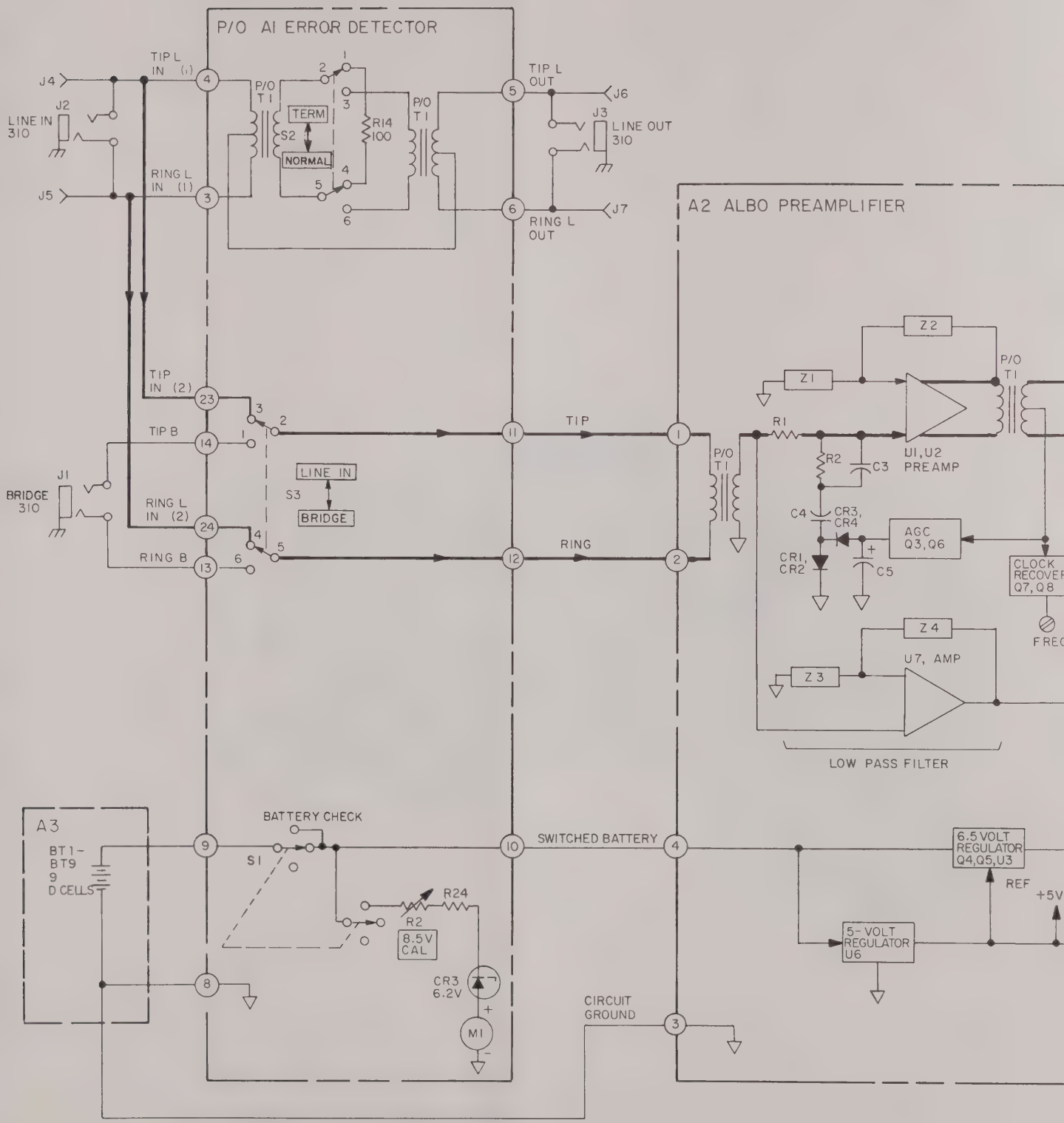
---

* An acceptable tuning wand is one manufactured by Siemens under part no. B63399-A1007-X000.

SECTION 7

DIAGRAMS

7.1 This section contains functional, interconnection, component location, and schematic diagrams.


P/O A1 ERROR DETECTOR
A2 ALBO PREAMPLIFIER
J4
J2
LINE IN 310
J5
TIP L IN (1)
RING L IN (1)
P/O T1
TERM
S2
NORMAL
R14 100
TIP L OUT
RING L OUT
J6
J7
J3
LINE OUT 310
TIP IN (2)
TIP B
RING L IN (2)
RING B
J1
BRIDGE 310
LINE IN
S3
BRIDGE
TIP
RING
Z1
Z2
Z3
Z4
R1
R2
C3
C4
C5
CR1, CR2
CR3, CR4
U1, U2 PREAMP
AGC Q3, Q6
CLOCK RECOVER Q7, Q8
U7, AMP
LOW PASS FILTER
A3
BT1-BT9 9 D CELLS
BATTERY CHECK
S1
R24
R2
8.5V CAL
CR3 6.2V
M1
SWITCHED BATTERY
6.5 VOLT REGULATOR Q4,Q5,U3
REF
+5V
5-VOLT REGULATOR U6
CIRCUIT GROUND

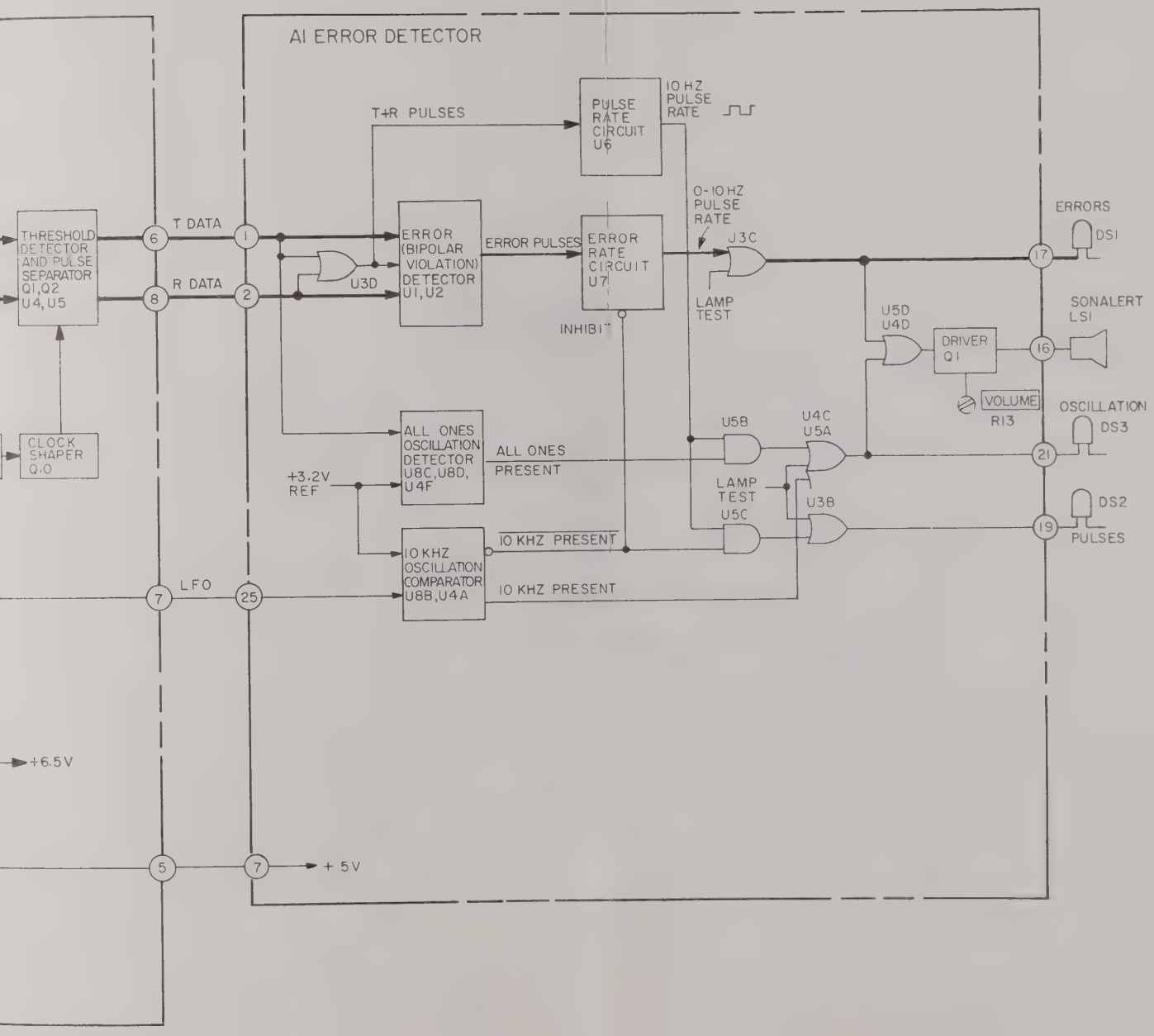


Figure 7—1. Model 7005A Functional Block Diagram.

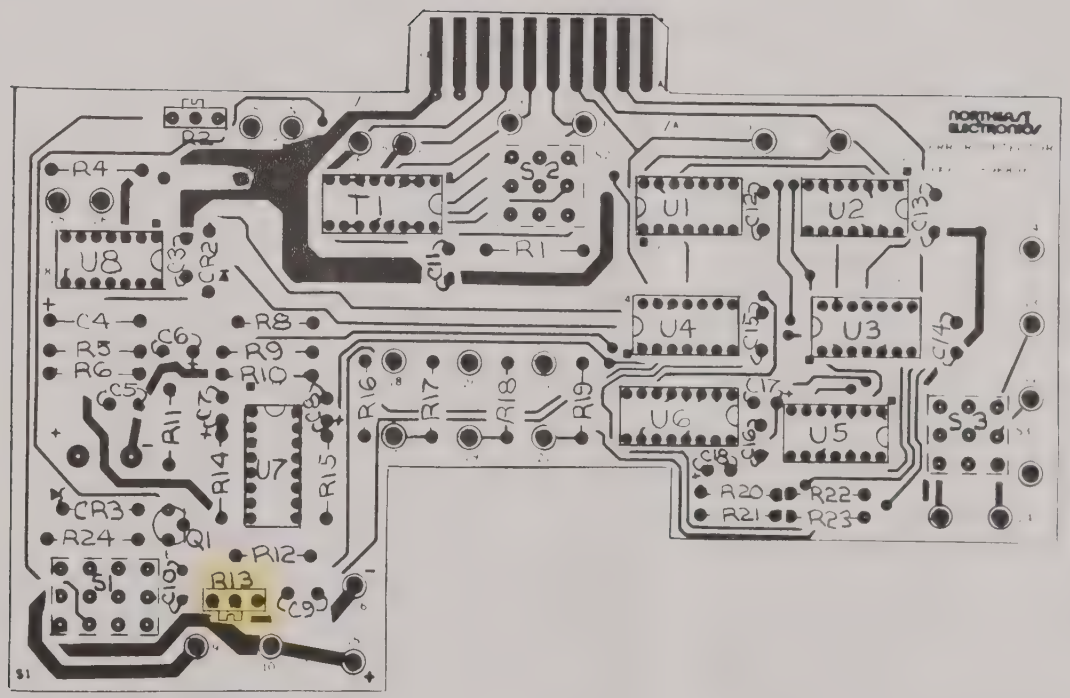
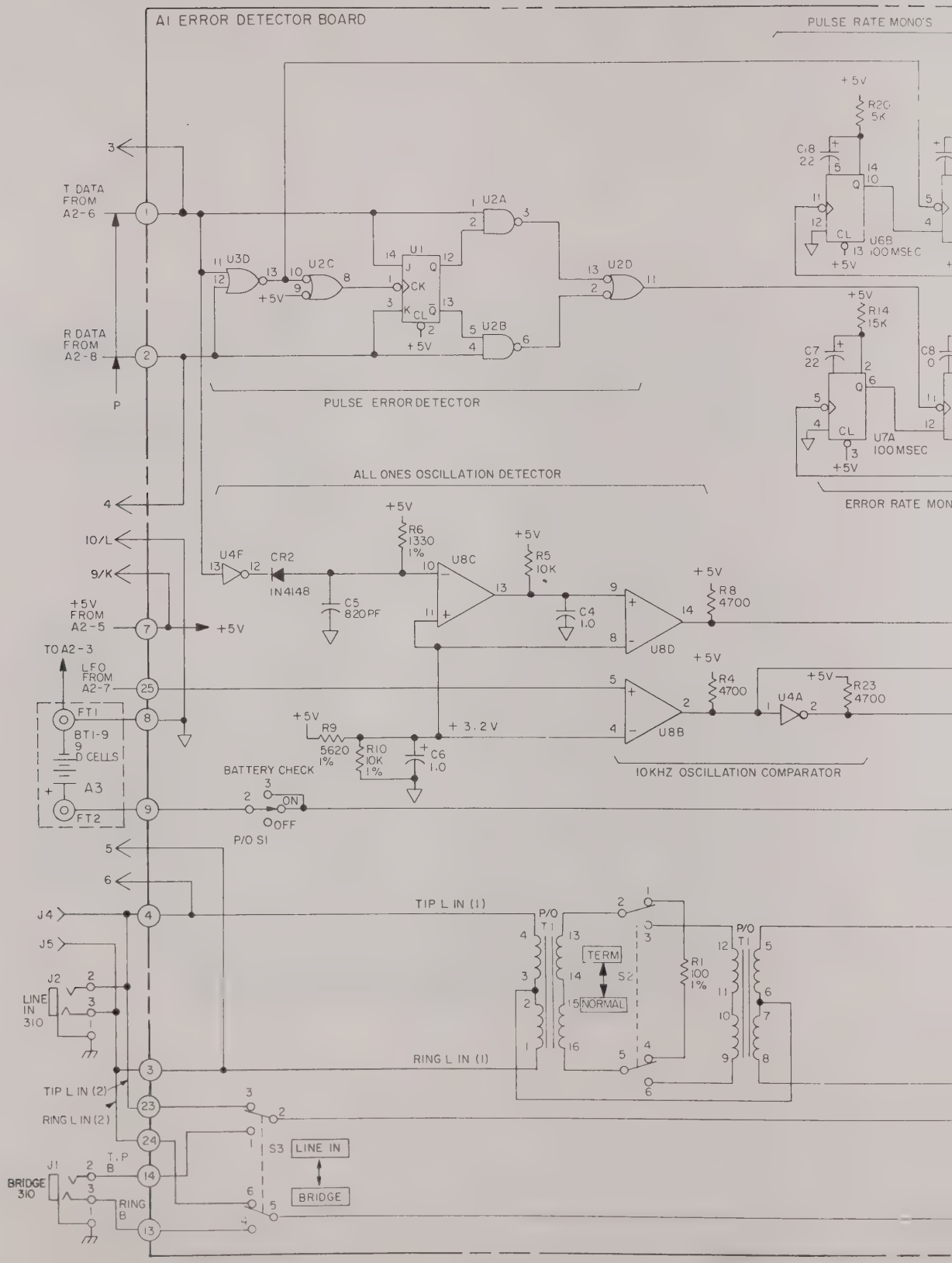
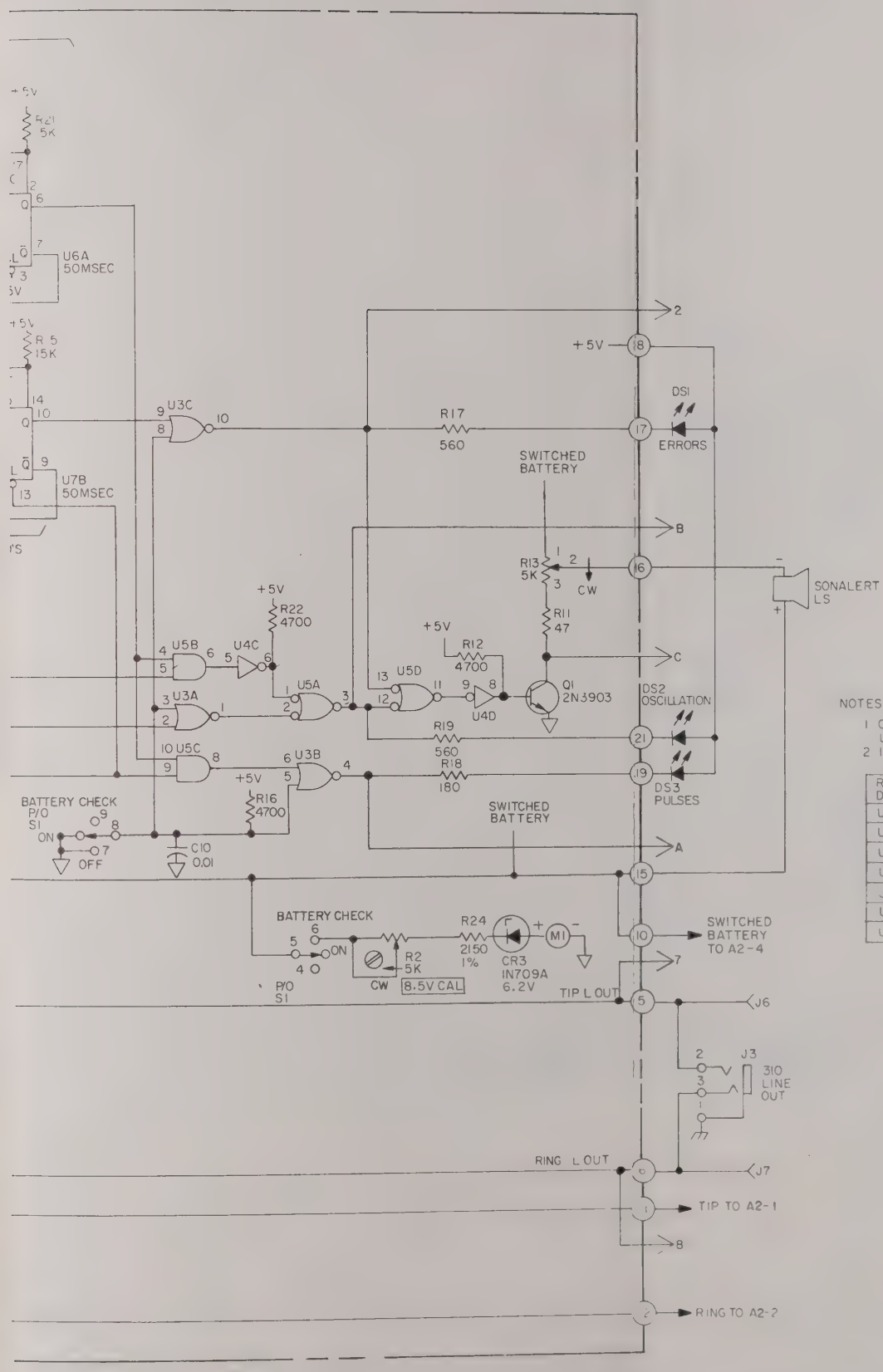


Figure 7—2. Error Detector Board A1
Component Location Diagram


A1 ERROR DETECTOR BOARD
PULSE RATE MONO'S
T DATA FROM A2-6
R DATA FROM A2-8
P
U2A
U3D
U2C
U1
U2D
U2B
+5V
PULSE ERROR DETECTOR
R20 5K
C18 22
U6B 100 MSEC
R14 15K
C7 22
C8 0
U7A 100 MSEC
ERROR RATE MON
ALL ONES OSCILLATION DETECTOR
10/L
9/K
+5V FROM A2-5
U4F
CR2
IN4148
C5 820 PF
R6 1330 1%
U8C
R5 10K
C4 1.0
R8 4700
U8D
TO A2-3
LFO FROM A2-7
FT1
BT1-9 9 D CELLS
A3
FT2
R9 5620 1%
R10 10K 1%
C6 1.0
+3.2V
BATTERY CHECK
ON
OFF
P/O S1
R4 4700
U4A
R23 4700
U8B
10KHZ OSCILLATION COMPARATOR
J4
J5
J2
LINE IN 310
TIP L IN (1)
RING L IN (1)
P/O T1
TERM
S2
NORMAL
R1 100 1%
TIP L IN (2)
RING L IN (2)
S3
LINE IN
BRIDGE
J1
BRIDGE 310
T.P B
RING B



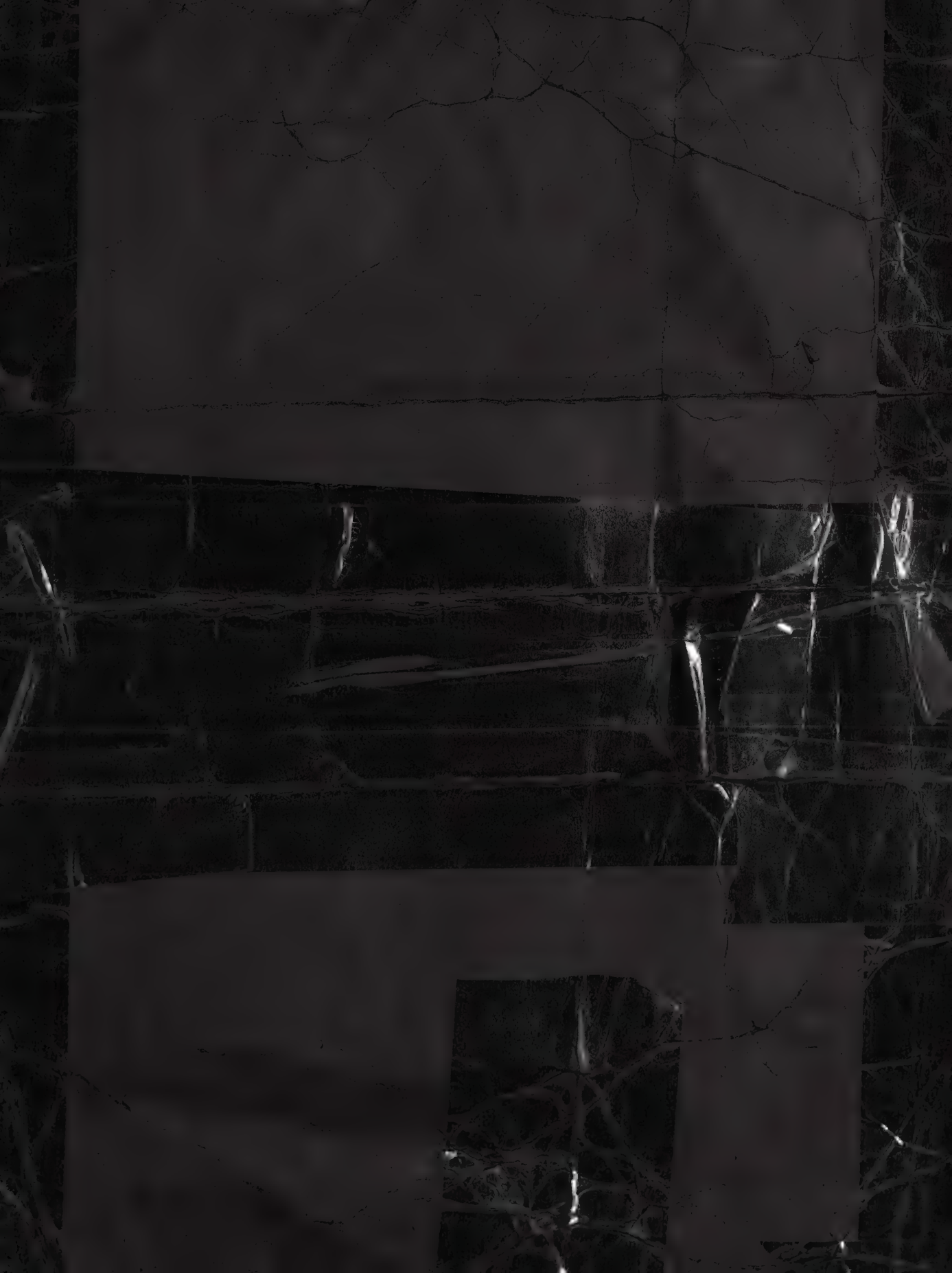
NOTES

1 CAPACITANCE IN MICOFARADS, UNLESS OTHERWISE SPECIFIED
2 INTEGRATED CIRCUIT DATA

REF DESIG.	TYPE	VCC	GND	BYPASS CAPACITOR(.01)
U1	SN7473	4	11	C11, C12
U2	SN74LS00	14	7	C13
U3	SN7402	14	7	C14
U4	SN74LS05	14	7	C15
U5	SN74LS08	14	7	—
U6,7	9602	16	8	C16, C9
U8	LM339	3	12	C3

	7005A
NE PART NO	A7005-10-010
REF DESIG	A1
PC NO	—

Figure 7—3. Error Detector Board A1 Schematic Diagram



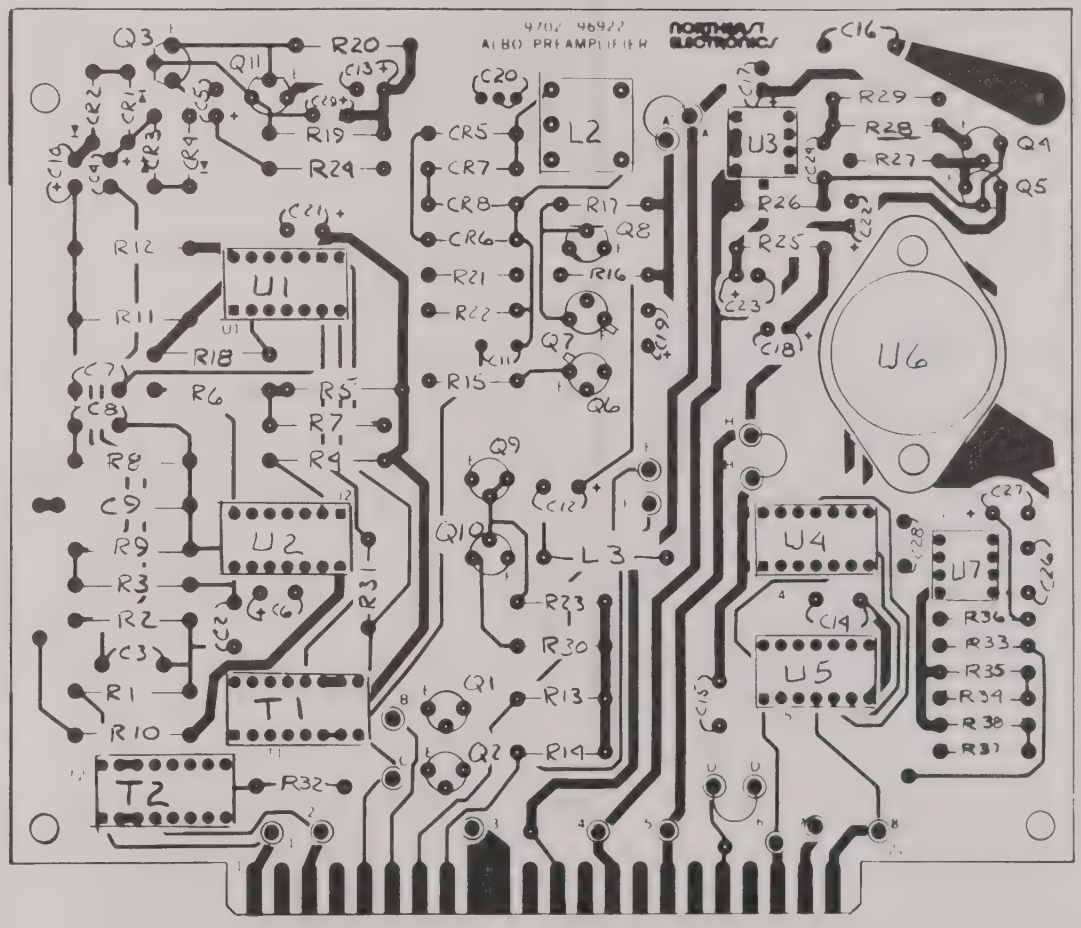
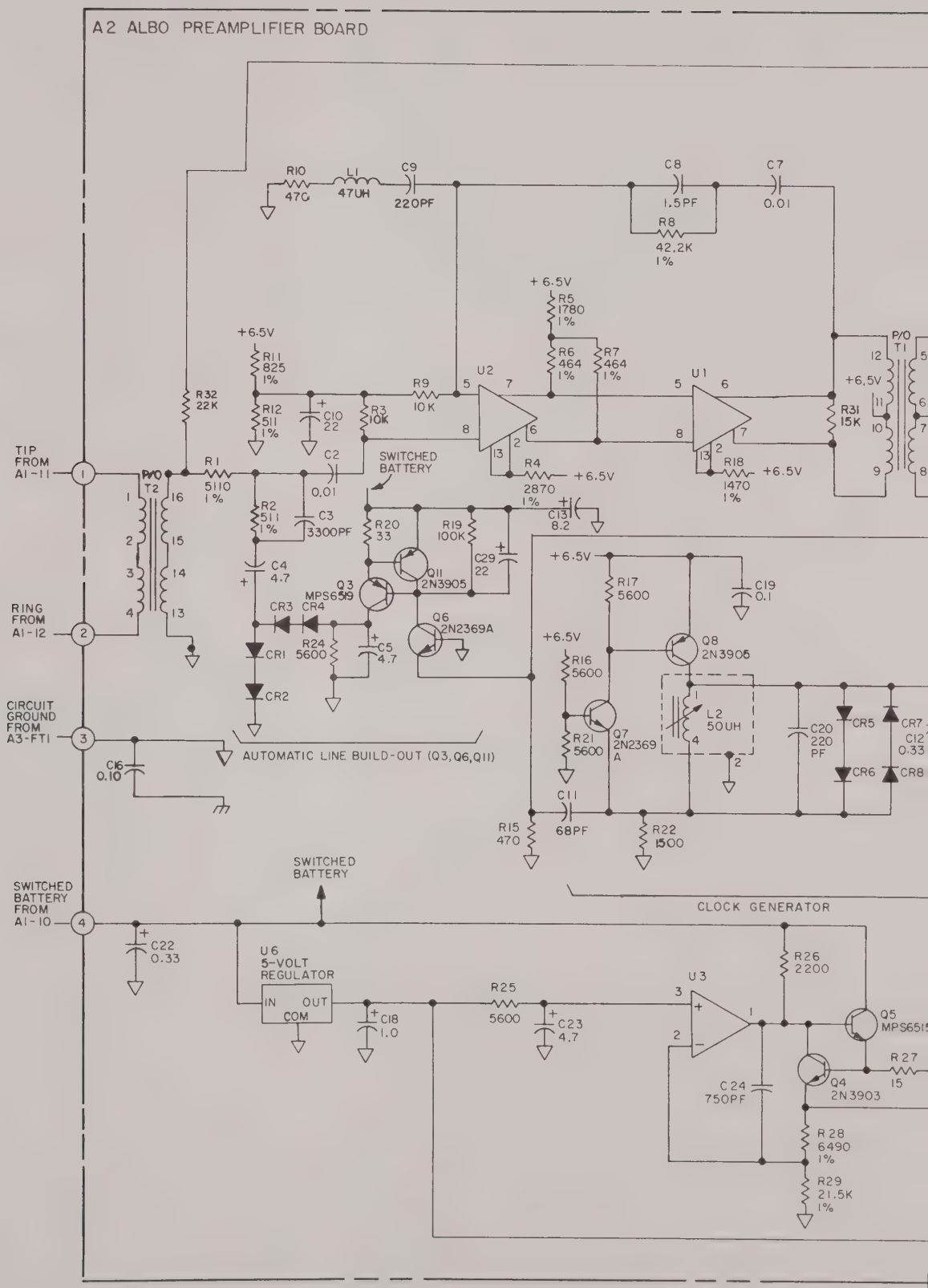
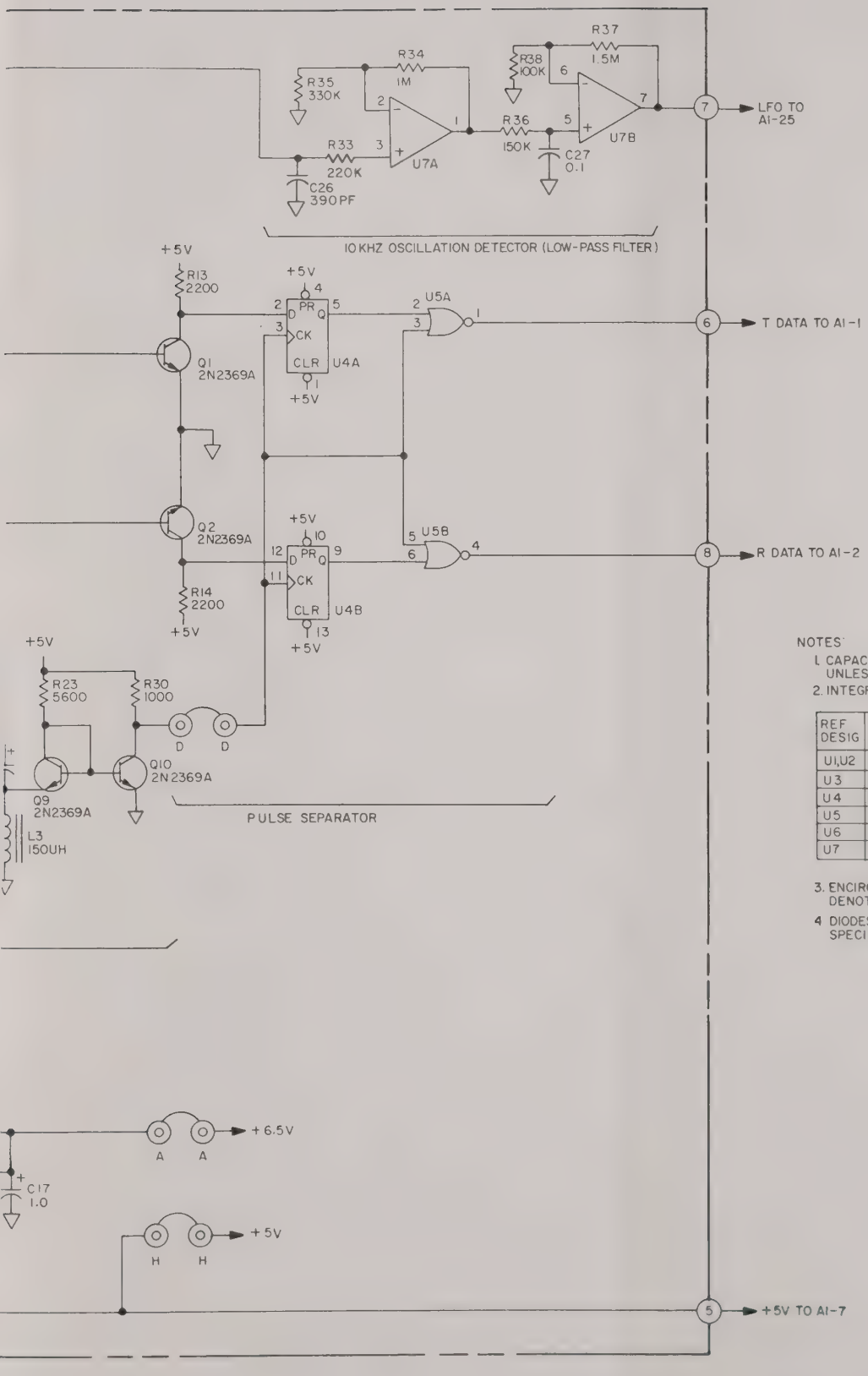


Figure 7—4. ALBO Preamplifier Board A2 Component Location Diagram


A2 ALBO PREAMPLIFIER BOARD
TIP FROM A1-11
RING FROM A1-12
CIRCUIT GROUND FROM A3-FT1
SWITCHED BATTERY FROM A1-10
SWITCHED BATTERY
AUTOMATIC LINE BUILD-OUT (Q3, Q6, Q11)
CLOCK GENERATOR
U6 5-VOLT REGULATOR
IN OUT COM
R10 470
L1 47UH
C9 220PF
C8 1.5PF
C7 0.01
R8 42.2K 1%
R5 1780 1%
R6 464 1%
R7 464 1%
R11 825 1%
R12 511 1%
C10 22
R3 10K
R9 10K
U2
U1
R32 22K
R31 15K
P/O T1
R1 5110 1%
C2 0.01
R4 2870 1%
R18 1470 1%
C13 8.2
P/O T2
R2 511 1%
C3 3300PF
C4 4.7
R20 33
R19 100K
C29 22
Q11 2N3905
Q3 MPS6519
Q6 2N2369A
CR1
CR2
CR3
CR4
R24 5600
C5 4.7
C16 0.10
R17 5600
C19 0.1
Q8 2N3905
R16 5600
R21 5600
Q7 2N2369A
L2 50UH
C20 220 PF
CR5
CR6
CR7
CR8
C12 0.33
C11 68PF
R15 470
R22 1500
C22 0.33
C18 1.0
R25 5600
C23 4.7
U3
R26 2200
Q5 MPS6515
Q4 2N3903
R27 15
C24 750PF
R28 6490 1%
R29 21.5K 1%



NOTES:

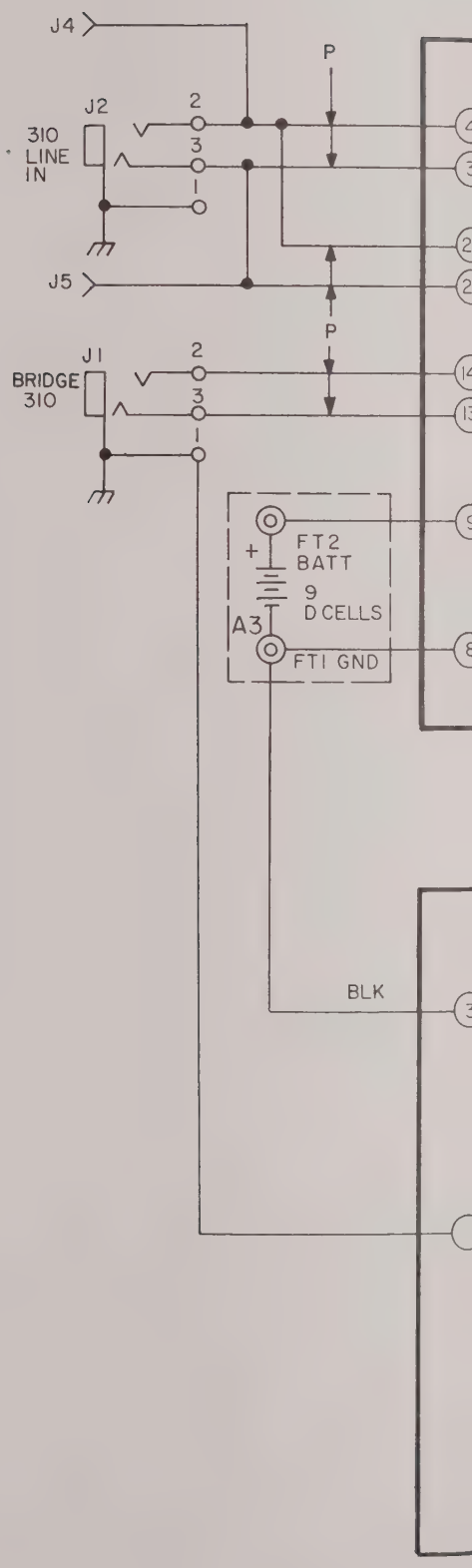
1. CAPACITANCE IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2. INTEGRATED CIRCUIT DATA

REF DESIG	TYPE	VCC	GND	BYPASS CAPACITOR
U1,U2	CA3050	9(+6.5V)	14	C21,C6(0.1)
U3	LM1458N	8(+13.5V)	4	———
U4	74LS74	14(+5V)	7	C14(.01)
U5	74LS02	14(+5V)	7	C15(.01)
U6	UA7805KC	—	—	—
U7	LM358	8(+5V)	4	C28(.01)

3. ENCIRCLED CONNECTION DESIGNATIONS DENOTE QUICK-DISCONNECT POSTS.
4. DIODES ARE IN4148 UNLESS OTHERWISE SPECIFIED

	7005A
NE PART NO	A7005-10-011
REF DESIG	A2
PC NO	96922

Figure 7—5. ALBO Preamplifier Board A2 Schematic Diagram


J4
P
J2
2
310
LINE
IN
3
1
J5
P
J1
2
BRIDGE
310
3
1
FT2
BATT
+
9
D CELLS
A3
FTI GND
BLK

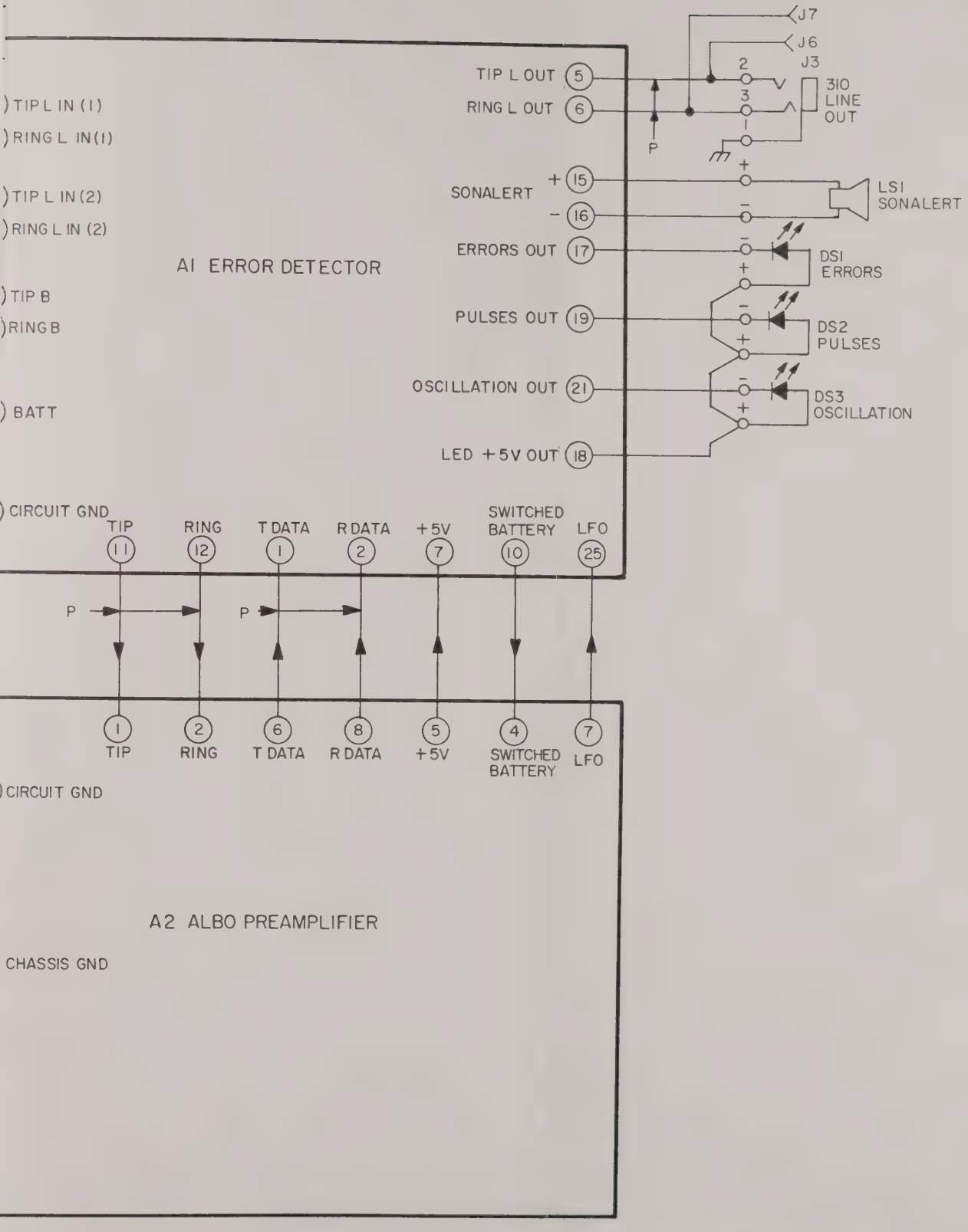


Figure 7—6. Model 7006A Interconnection Diagram

SECTION 8

ELECTRONIC PARTS LISTS

8.1 This section contains the electronics parts lists for the Model 7005A.

Table 8—1. Model 7005A Overall Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E. PART NO.
A1	PC 96922 ALBO PREAMP.						A700510011
A2	PC 96896 ERROR DETECTOR						A700510010
DS1-2		10 MA			H.PACKARD	5082-4658	564500801
DS3	LED,HI EFF.GREEN				H.P.	5082-4958	564500807
J1-3	HI-D				SWCRFT	M-112B	680101300
J4	BINDING POST-RED				GRAYHILL	29-1R	652400400
J5	BINDING POST-BLK				GRAYHILL	29-1B	652400300
J6	BINDING POST-RED				GRAYHILL	29-1R	652400400
J7	BINDING POST-BLK				GRAYHILL	29-1B	652400300
LS1	80DB				MALLORY	SC628	566500100
M1		5			EMICO	802PJR	901500100
XDS1-2	LED MTG. CLIP FOR T1 3/4				VISUAL COM	CLF-280-RTP	850501101
XDS3	LED MTG. CLIP FOR T1 3/4				VISUAL COM	CLF-280-GTP	850501102

Table 8—2. Error Detector A1 Parts List

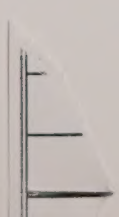
REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E. PART NO.
C3	.01UF		20%	16V	CENTRALAB	UK16-103	330701031
C4	1 MF	A	20%	35V	SPRAGUE	196D105X0035HA1	310801050
C5	820 PF		5%	300V	ELMENCO	CM05-C821JO	335408210
C6	1 MF	A	20%	35V	SPRAGUE	196D105X0035HA1	310801050
C7	22UF	B	10%	15V	SPRAGUE	196D226X9015KA1	310802263
C8	10UF	B	20%	20V	SPRAGUE	196D106X0020JA1	310801060
C9-16	.01UF		20%	16V	CENTRALAB	UK16-103	330701031
C17	10UF	B	20%	20V	SPRAGUE	196D106X0020JA1	310801060
C18	22UF	B	10%	15V	SPRAGUE	196D226X9015KA1	310802263
CR2	DO35	4NS 1JMA	SI	50UA	FAIRCHILD	IN4148	560041480
CR3	DO7	250MW	5%	6.4	SIEMENS	1N709A	562007091
Q1	TO-92	350MW TA	NPN	40V	MOTOROLA	2N3903	550039030
R1	100-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220210001
R2	5K	1/2W	10%	200V	HELIPOT	72XWR5K	232705020
R4	4.7K	1/4W	10%		AB	TYPE CB	200104726
R5	10K	1/4W	10%		AB	TYPE CB	200101036
R6	1330-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220213311
R8	4.7K	1/4W	10%		AB	TYPE CB	200104726
R9	5.62K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220256211
R10	10K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220210021
R11	47-	1/4W	10%		AB	TYPE CB	200104706
R12	4.7K	1/4W	10%		AB	TYPE CB	200104726
R13	5K	1/2W	10%	200V	HELIPOT	72XWR5K	232705020
R14-15	15K	1/4W	10%		AB	TYPE CB	200101536
R16	4.7K	1/4W	10%		AB	TYPE CB	200104726
R17	560-	1/4W	10%		AB	TYPE CB	200105616
R18	180-	1/4W	10%		AB	TYPE CB	200101816
R19	560-	1/4W	10%		AB	TYPE CB	200105616
R20-21	15K	1/4W	10%		AB	TYPE CB	200101536
R22-23	4.7K	1/4W	10%		AB	TYPE CB	200104726
R24	2150-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220221511
S1	4PDT				C+K	7413P3H3CB	620402300
S2-3	3PDT	5A2		28V	C+K COMP	7301P3H3CB	620401900
T1	16DILP				ARTTED	AC8326	440200100
U1	14DIP-P			TTL	TI	SN7473N	510074730
U2	14 DIP-P			LS	T.I.	SN74LS00N	510907400
U3	14DIP-P			TTL	TI	SN7402N	510074020
U4	14 DIP-P			LS	T.I.	SN74LS05N	510907405
U5	14 DIP-P			LS	T.I.	SN74LS08N	510907408
U6-7	16DIP-P			DM3	FAIRCHILD	9602PC	510096025
U8	14 DIP				NAT.SEMI	LM339N	500000339

Table 8—3. ALBO Preamplifier Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E. PART NO.
C2	.01UF		00	50V	CENTRALAB	CK-103	330701030
C3	3300PF		2%	500V	ELMENCO	CM06FD332G0	335403320
C4-5	4.7UF		10%	25V	KEMET	T330A475K025AS	310004751
C6	.1UF		10%	35V	KEMET	T330A104K035AS	310001041
C7	.01UF		00	50V	CENTRALAB	CK-103	330701030
C8	1.5PF DI	NPO	5%	1KV	SPRAGUE	10TCC-V15	330301590
C9	220PF		5%	500V	ELMENCO	CM15-E221J	335002210
C10	22UF		10%	6V	KEMET	T330A226K006AS	310002260
C11	68PF DB	N3300	10%	1KV	CENTRALAB	DD-680	330006800
C12	.33UF		10%	50V	KEMET	T330A334K050AS	310003340
C13	8.2UF		10%	15V	KEMET	T330A825K015AS	310008250
C14-15	.01UF		00	50V	CENTRALAB	CK-103	330701030
C16	.1UF	D0 Z5U	20%	500V	SPRAGUE	5GA-P10	330401040
C17-18	1UF		10%	35V	KEMET	T330A105K035AS	310001051
C19	.1UF		10%	35V	KEMET	T330A104K035AS	310001041
C20	220PF MC	NPO	5%		USCC	CN20A221J	330802210
C21	.1UF		10%	35V	KEMET	T330A104K035AS	310001041
C22	.33UF		10%	50V	KEMET	T330A334K050AS	310003340
C23	4.7UF		10%	25V	KEMET	T330A475K025AS	310004751
C24	750PF DB	Z5R	10%	1KV	CENTRALAB	DD-751	330007510
C26	390PF DB	Z5F	10%	1KV	CENTRALAB	DD-391	330003910
C27	.1UF		10%	35V	KEMET	T330A104K035AS	310001041
C28	.01UF		00	50V	CENTRALAB	CK-103	330701030
C29	22UF		10%	6V	KEMET	T330A226K006AS	310002260
CR1-8	D035 4NS 10MA		SI	50UA	FAIRCHILD	IN4148	560041480
L1	47UH		5%		NYTRONICS	WEE-47	461001200
L2	50 UH				NTL	GHP 1268-1 A0243375	455100801
L3	150UH		5%		NYTRONICS	WEE-150	461000700
Q1-2	TO-18 360MW	TA NPN		15V	FAIRCHILD	2N2369A	550023691
Q3	TO92 350MW	TC PNP		25V	MOTOROLA	MPS6519	552065190
Q4	TO-92 350MW	TA NPN		40V	MOTOROLA	2N3903	550039030
Q5	TO-92 350MW	TA NPN		25V	MOTOROLA	MPS6515	550065150
Q6-7	TO-18 360MW	TA NPN		15V	FAIRCHILD	2N2369A	550023691
Q8	TO92 350MW	TC PNP		40V	MOTOROLA	2N3905	552039050
Q9-10	TO-18 360MW	TA NPN		15V	FAIRCHILD	2N2369A	550023691
Q11	TO92 350MW	TC PNP		40V	MOTOROLA	2N3905	552039050
R1	5110-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220251111
R2	511-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220251101
R3	10K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220210021
R4	2870-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220228711
R5	1780-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220217811
R6-7	464-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220246401
R8	42.2K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220242221
R9	10K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220210021
R10	470-	1/4W	5%		A.B	TYPE CB	200104715
R11	825-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220282501
R12	511-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220251101
R13-14	2.2K	1/4W	10%		AB	TYPE CB	200102226
R15	470-	1/4W	10%		AB	TYPE CB	200104716
R16-17	5.6K	1/4W	10%		AB	TYPE CB	200105626

Table 8—3. (Cont'd)

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E. PART NO.
R18	1470-	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220214711
R19	100K	1/4W	10%		AB	TYPE CB	200101046
R20	33-	1/4W	10%		AB	TYPE CB	200103306
R21	5.6K	1/4W	10%		AB	TYPE CB	200105626
R22	1.5K	1/4W	10%		AB	TYPE CB	200101526
R23-25	5.6K	1/4W	10%		AB	TYPE CB	200105626
R26	2.2K	1/4W	10%		AB	TYPE CB	200102226
R27	15-	1/4W	5%		A.B.	TYPE CB	200101505
R28	6.49K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220264911
R29	21.5K	1/8W	1%		ELECTRA	RN55 SIZE 100 PPM	220221521
R30	1K	1/4W	10%		AB	TYPE CB	200101026
R31	15K	1/4W	10%		AB	TYPE CB	200101536
R32	22K	1/4W	10%		AB	TYPE CB	200102236
R33	220K	1/4W	10%		AB	TYPE CB	200102246
R34	1M	1/4W	10%		AB	TYPE CB	200101056
R35	330K	1/4W	10%		AB	TYPE CB	200103346
R36	150K	1/4W	10%		AB	TYPE CB	200101546
R37	1.5M	1/4W	10%		AB	TYPE CB	200101556
R38	100K	1/4W	10%		AB	TYPE CB	200101046
T1-2	16DILP				ARTTED	AC8326	440200100
U1-2	14DILP				RCA	CA3050	500030500
U3	8PD1L	80MW		180V	NAT.SEMI	LM1458N	500001458
U4	14 DIP-P			LS	T.I.	SN74LS74N	510907474
U5	14 DIP-P			LS	T.I.	SN74LS02N	510907402
U6	TO-3			5V	FAIRCHILD	7805KC	500078051
U7	8 DIP-P				NATIONAL	LM358N	500000358



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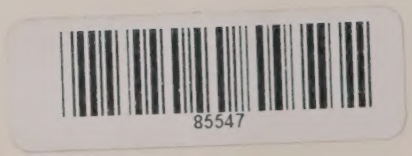

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